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The Microscope: An Important Industrial Instrument in Analysis, Testing and Manufacture

PART I

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Varied Applications—Potentialities—American Industry Slow in Recognition—Direct Part Played Is Physical—Extent of Successful Use Depends Upon Observer—Application in Chemistry—Special Applications—Working Operations—Control of Raw Materials—Control of Processes—Machinery—Finished Materials—Authentic Records

1—The Microscope of Proved Value to Industrial Workers

Of all the optical instruments which have proved of great worth to industrial workers in aiding the solution of many types of physical, chemical and biological problems frequently confronting them, the microscope is by far the most important. In some instances the use of the microscope has been indispensable, the information being obtainable in no other way, or, at least, not with the same accuracy. In other cases its use has been to supplement or to substantiate the results of other ways of investigating the same problem, while in a large number of its applications it has been a direct aid in carrying out the usual methods themselves—these being done under the microscope, instead of in outside containers.

The gains from its employment have often been a better understanding of the workings of a process, with subsequent better control; various advances in methods, apparatus and materials, and the selection of remedial treatments for defects or abnormal conditions. In analysis and testing, whether qualitative or quantitative, the rapidity and accuracy gained and economy of labor, expense and materials have proved of great value. Coupled with these gains are the wide diversity of its uses and the mobility of the instrument, which many times permits it to be located at a spot close to the work in question in laboratory, workroom, machine or office. All of these factors have contributed greatly to the value of the microscope as an industrial instrument.

The extent of its worth has been amply proved in those fields where the details of its application have been scientifically studied, recorded in literature, and used until they have become common property. Most notable among these is that of biological science. Here the vast accumulation of knowledge and methods related to the study of micro-organisms—bacteria, molds, yeasts and fungi—in their beneficial and harmful actions, and of the minute structure of all parts of larger plants and animals, has found successful and wide application. The microscope plays an important and continuous part in all of these uses.

The medical and surgical professions apply them, with far-reaching results, to human beings and domesticated animals, and the horticulturist to cultivated plants, in the prevention, diagnosis, treatment and cure of infectious diseases and other morbid conditions.

Those large industries demanding the presence or the absence of micro-organisms for a part or the whole of a process, place much dependence upon the revelations of the microscope. Among such might be mentioned, first, those industries using fermentation or putrefaction processes, as for the production of alcohols, organic acids (acetic, butyric, lactic, citric), or for the removal of protein or other foreign matter, as in leather tanning, and in flax; second, those making or using medical preparations (vaccines, sera and cultures), and, third, the makers of cheeses and other foodstuffs depending upon the action of bacteria and fungi for ripening processes. In all such types of industries the presence of micro-organisms is desired and regulated. On the other hand, in the canning and preserving of foods and drinks, and in the storage of other perishable goods, the absence of most organisms is demanded.

A more universal industrial application, still requiring biological knowledge, is prevalent. This is in connection

with those industries using non-living, biologic products of plant or animal origin, such as flours, starches or their derivatives, fibers, herbs and natural drugs, spices, foodstuffs, seeds, woods and wood fibers, bone products, and similar materials. With all these it may be desired to identify kinds, origin or previous treatment, and to know quality, purity and condition.

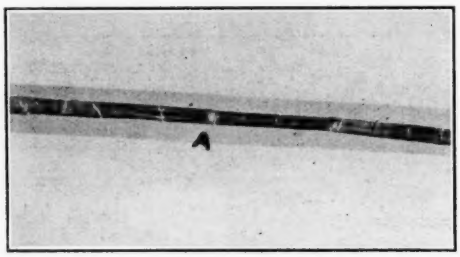

FIG I—*Linen* (× 100)

These biologic uses are so well realized in the general mind as almost to lead to the erroneous conclusion that the microscope is an instrument peculiar to the biological world.

That such is not the case, however, is fully demonstrated in other fields by different types of uses not related to the physics and chemistry of biology but to those of everyday industrial life. Along with the employment of the microscope, in its early history, to the study of animal and plant forms there was developed another application involving the examination of crystalline bodies. From this type of use has been developed the science of "crystallography." Numerous instances of scientific and industrial uses of crystallography are in evidence, as in the identification of substances in chemical analysis, in the study of rocks, minerals and ores, and in metals. The metallurgical world has found the microscope to be of such great value in controlling and improving processes, alloys and in studying results of testing that to-day those industries under scientific control, making or using metals and alloys, depend a great deal upon the rapidity and accuracy of the microscope in their daily working.

A last extensive use of the microscope is as an aid to vision in carrying on working operations of hand or sight, where the object worked with, or the work being

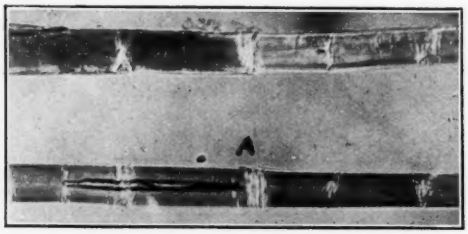

FIG. II—*Linen* (× 250). *Compare for Detail and Increased Magnification*

done, is visible but indistinct. The use of low powers of magnification, in the forms of "magnifiers," "glasses" or "lenses," makes possible more rapid, accurate and minute work, with great saving of materials, expense and eyestrain, by engravers, repair men, readers of fine graduations, or by those making nice adjustments of tools and measuring devices, or in studying the structure of yarns, fabrics, papers, etc.

In the cases of biological materials and crystalline bodies, and other applications in textile chemistry where fine working operations are involved, the value of the microscope is beyond adequate expression.

2—THE POSSIBILITIES FOR APPLYING THE MICROSCOPE NOT EXHAUSTED WITH THESE ILLUSTRATIONS

While the given illustrations of the successful early employment of the microscope serve to indicate clearly the positive values to be derived from its industrial use, they have by no means been taken advantage of to their fullest possible extent. Furthermore, they by no means exhaust the list of possible and desirable adaptations of

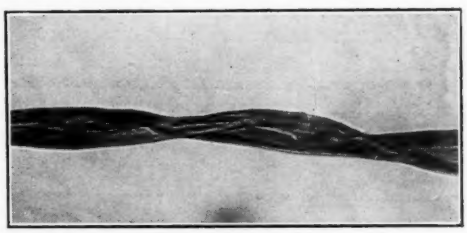

FIG. III—*Cotton, Bleached* (× 250)

this "versatile" instrument. The same general kinds of optical physical and chemical properties utilized for microscopic observation in the industries illustrated are present in varied forms in many other industrial connections. They may be used to advantage in the study of problems concerning materials, machinery, processes and finished goods, both in research and in normal control. There is, then, still a wide field to be developed in the industrial use of the microscope.

It is unfortunate, from the viewpoint of microscopists, that the general American industrial world has been relatively slow in actively recognizing the usefulness of the microscope. Some of the reasons for the slow progress are not hard to find. There appears to be, among industrial men, an unfamiliarity with the instrument, its accessories, the simple methods of its use, what it does and what it can be made to do. This is but a natural condition, for small opportunity is offered them to come into personal contact with the instrument in the daily routine of their work. More important still is the fact that the current literature of the average technical man includes but little in regard to this subject.

This condition may also be due to the fact that it is only within recent years that trained chemists and engineers have received instruction in its use. Previously they had had but an inadequate, passing introduction to it in their training, and as a result they have in most cases failed to

grasp an insight into its latent possibilities. Many of those who did receive some school training obtained it from biological sources, so that any future advances into their own field depended a great deal upon their own initiative and efforts. The result has been a general failure to realize the full possibilities of the instrument, not only among regular industrial men but also among its casual users.

The existence of this natural unfamiliarity and inappreciation among industrial workers has not been reduced, or offset, by a persistent, widely disseminated literature from the more successful microscopists. No extended system of educational "propaganda" has been used to attract wide attention to the industrial value of the instrument. Embryonic microscopists and average workers have also been dampened in their ardor by the necessity of developing their own methods, where special methods are needed, and of collecting their own data and descriptions in the new fields of use, through their own applications of principles. This factor, also, has contributed considerably to a delayed increase in the use of the microscope.

Thus, there is great need for continued co-operation and research among industrial users of the microscope to further develop and adapt more special methods where needed, to gather data suited to the industrial use where uncommon information is demanded, and to make these more readily available in forms which will enliven an

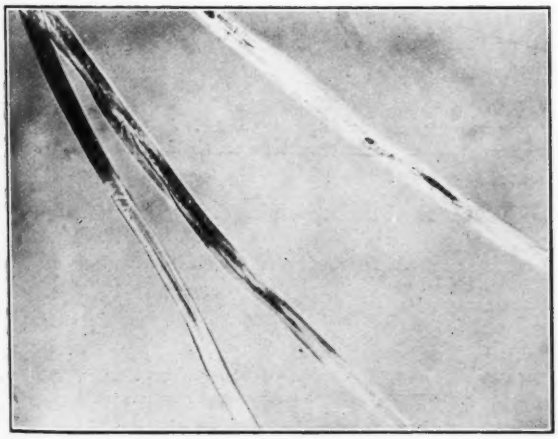

FIG. IV—*Cotton, Bleached and Mercerized. Compare for Change in Appearance Due to Treatment*

appreciation of the instrument among those less acquainted with it.

It is the purpose of this paper to help draw general attention to the proved usefulness of the microscope when applied to the many forms of industrial problems within its province, and to help stimulate an increased interest which shall lead more workers to investigate the literature of microscopy,[1] study the principles employed and apply these to the extension of their own use of this valuable instrument.

[1] See Decennial Index to Chemical Abstracts, etc.

3—The Direct Part Played by the Microscope Is Physical

Before discussing with detail some of the possible applications of the microscope, it is desirable to call to mind, in general terms, just what the instrument does in

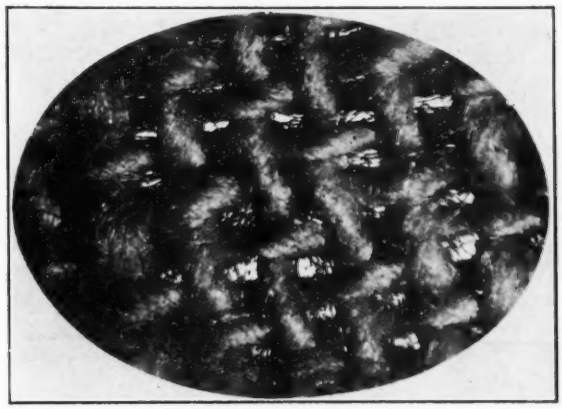

FIG. V—*Cotton Cloth, Bleached, Showing Dust Particles and Twist*

performing its part. The microscope does no more than give a visual, physical "image" of the object placed in its "field." It reveals visual, physical properties. There are shown shapes, sizes, colors, arrangement, relative position and perfection of parts, details of particular markings or appearances on surfaces, peripheries, or transparent interiors, which are due to peculiarities of structure, composition or treatment. These are brought out visibly with progressive fineness as the power of magnification is increased. They are all, directly, physical revelations. Compare Figs. I and II; also Figs. III, IV and V.

4—The Extent of Successful Use Dependent Upon the Observer

While it is the function of the microscope, as an instrument, to make physical revelations, the sphere of its use includes not only the physical but that part of the chemical world which can be inferred from visible physical changes. The observer may lay hold upon the maximum possible benefits in direct proportion to his ability to connect his physical and chemical knowledge with "what he sees," and with his microscopical "technique" in making visible, by proper treatment of the object, all or any of those things or properties located in it, which he may be able to use in making his deductions. He may gather his facts, at times, from the observation of a single condition of the object, or, at others, by comparing observed changes in physical appearances in successive fields, upon treatment of the object with differentiating conditions as of heat, light, pressure, solvents, reagents, etc. With the lower powers of magnification, the microscopic appearances are closely akin to those of ordinary vision and interpretation of them (i. e., recognizing what

is seen) is therefore easy. As the power of magnification becomes higher the details become more minute and more unrelated to familiar everyday appearances. Then the observer must familiarize himself with these appearances and apply his knowledge to the specialized cases before him, as from a new viewpoint. Microscopy draws heavily upon the observer's knowledge of optical physical and chemical properties, and of the effects of physical and chemical agencies upon these properties. The study, upon proper interpretation, shows conditions as they are, what goes on during treatment, and what are the results of the treatment.

5—Some Special Applications of the Microscope

With these suggestions in mind as to the function of the microscope and as to the general factors and properties of objects which it uses in making its revelations, more specialized applications can easily be seen. It is obvious that these microscopical characteristics are to be found in many reagents, chemicals and materials, and, if one will but acquaint himself with them, may be used in laboratory testing, in workroom control, or research, in connection with the manufacture or use of leather, textiles, rubber, ceramics, metals, minerals and ores, and in the preparation or mixing of powdered materials, emulsions, suspensions, colloids, etc. Some of the recorded

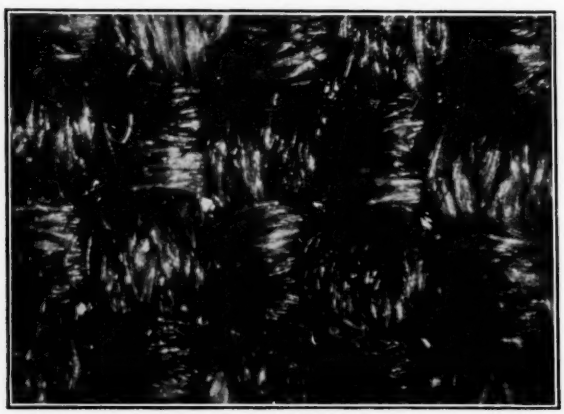

Fig. VI—*Worsted Cloth*

applications of the instrument may be suggested under the following heads. Other possible uses will undoubtedly occur to the reader along his own lines of work.

A—The Microscope as an Aid to Working Operations

(*a*) *Fine Manual Labor.*—There are many cases in industrial life where it would facilitate the carrying out of the work if the range of sight could only be extended a moderate amount, so that the workman could see better what he has done and is doing; where he could work more accurately and rapidly if he could only see distinctly the relative position of the instrument with respect to the piece of material; where the minute part he is replacing is to go; whether the place is in proper condition. Thus, in engraving, repairing, adjusting or setting of cutting tools [2] and instruments, inspecting, mending fine fabrics, and such like, are found splendid opportunities for using low powers of magnification. The fact that microscopes suitable for this kind of work can be placed into almost any style of mechanical holders possessing convenience for specialized purposes, is a further help in making their employment easy and satisfactory.

(*b*) *Fine Reading Operations.*—The reading of fine graduations or other distinguishing marks and characters on instruments, records, labels, tags and containers, etc., is done much more easily through the microscope than with the naked eye. Many times, on account of partial effacement through corrosion, erasure or stains, or because of being located in a place poorly lighted or one hard to get at, a microscope will help a great deal. The microscope can often perform good detective work in revealing the presence of erasure or abrasion marks, alterations or differences in writing, the presence of foreign fingerprints, the substitution of kinds of paper, etc. In all of these kinds of cases the operation of the instrument is simple and the characters for the most part easily recognized. Little special experience is necessary, because the appearances are closely related to those of ordinary vision.

(*c*) *Microphysical and Michrochemical Testing.*—As a laboratory instrument, Chamot,[3] a leading chemical microscopist, considers the microscope second in importance only to the analytical balance, because of the great variety of uses to which it may profitably be put with an almost equal degree of ease. The carrying out of the usual physical and chemical tests where a visible change is relied upon can frequently be done under the microscope with a great saving of time, material and reagent, without sacrificing accuracy. In cases of small quantities, as when unweighable amounts are at hand, the accuracy of the test may be augmented. Micro testing has several ardent supporters, and furnishes a broad field of possible, useful applications. The determinations of relative solubility, melting points, refractive indices, action with polarized light, crystalline form, spectrum formations, colorations and the computing of weights (from measurements and densities) have all been done to advantage.

Qualitative analysis, using tests involving differential solution actions, precipitations and actions mentioned above, as well as micro quantitative applications of methods in oil, powders and ground materials, has been done with good satisfaction. In the testing of dyestuffs upon fibers, in determining the presence of foreign matter on fabrics (stains, finishing materials, etc.) due to solid particles in the interstices of the fibers or threads, in the examination of insoluble residues extracted from commercial trade compounds, etc., a suitable selection of proper methods for further testing, or a clue as to origin, com-

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[2] Article by Rogers: "Microscope in Workshop."

[3] Chamot, Elementary Chemical Microscopy.

position, method of application or proper course of remedy may be gained which will be of great service. A sight of the true condition often has a marked effect upon our course of reasoning and action.

As an illustration of an instance where the simple process of a microscopic examination would have given conclusive evidence as to the real cause of trouble, with the saving of a considerable amount of time, labor, material and irritation, there comes to mind the case of an olive-drab fabric with a surface appearance of uneven coloration. The appearance suggested very strongly the presence of a slight surface nap which had subsequently been dyed a darker shade than the main body of the fabric. The dyer claimed it was due to abrasion in the bleaching operations. The bleacher, naturally enough, denied the charge. He nevertheless took the precautions to inspect, thoroughly clean and smooth off his machinery. The condition of the dyed fabric was not improved. After several pieces had been put through with no improvement, outside advice was consulted. The simple procedure of putting the cloth under a microscope showed the cause of the trouble immediately. The surface of the cloth was undamaged, but there were very tiny blue specks pressed onto the surface fibers. The fabric had been dyed with sulphur colors. A test, under the instrument, for sulphur colors eliminated the specks and proved them to be dyestuff. The dyer by using more care in his solution process eliminated the trouble. If he had used the microscope on the first piece he would have been able to save himself much trouble.

It is very evident, then, that the microscope may be made to do valuable service in the laboratory or workroom as an aid to micro-testing, and in aiding the solution of problems requiring the use of other methods as well.

B—The Microscope in the Control of Raw Materials

The microscope may often be used to advantage in selecting and in controlling the quality of raw materials. It may do valuable service in identification of kinds, origin, composition to show purity, admixture or adulteration, grade, conditions of ripeness (vegetable fibers), uniformity, damage or previous treatment. Compare Figs. III and IV. Its suitability for the given purpose may at times be judged by its appearance, also the need for further preparation, mixing, etc. The presence of infectious or other deleterious matter may show itself.

Some observers have applied the instrument to determining the seam origin and quality of coal. Further applications to animal and vegetable products and to mineral,[4] abrasive and coloring powders, organic and inorganic in origin, are met with.

In these cases much is often made of measurement and comparison of the appearance of the submitted samples with those of a standard sample which has proven satisfactory. The experience necessary to interpret, naturally, varies with the kinds and conditions of object. The more characteristic the appearance—that is, the fewer the number of objects which possess the same or closely similar appearances—the easier is the problem.

C—The Microscope as an Aid in the Controlling of Processes

There are some processes in which the microscope finds good usage. It may be to tell the need of a material for the process in question, or to determine the extent to

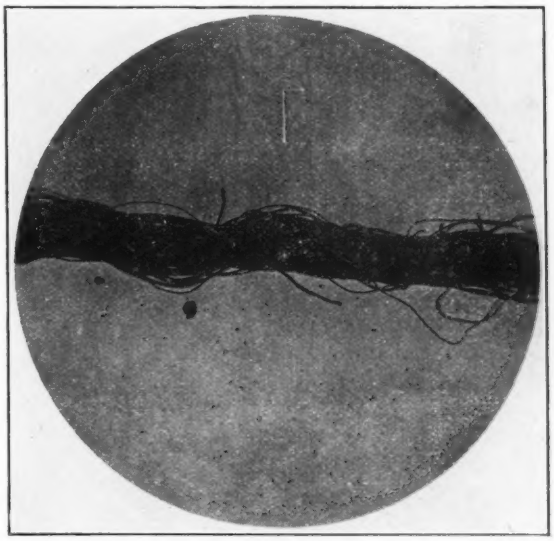

FIG VII—*Worsted Yarn*

which it has gone on and how near to completion it may be, or in noting the presence and tracing down an abnormal action in its operation. Some investigators make a systematic study of the normal effects upon the material of the well-working process under proper conditions of concentration, reaction, temperature, pressure and machinery. They do some research work upon the effects of abnormal conditions and find the information from both cases often of help in controlling the process. One worker follows the material (in this case working with cotton) from one process to another, and finds it profitable to do so.

Such processes as those using surface coatings, infiltrations, penetration, subdivision and cleansing may show information of value when studied systematically. If any of these have been improperly or insufficiently done, or damage, imperfection or other difficulty has been encountered, the microscope may be of service in detecting them and in finding a remedy. In research study for the improvement of a process, the effects of varied conditions and kinds of materials may be studied. In yarn study the twist and uniformity may be observed minutely. See Fig. IV.

D—The Microscope Applied to Machinery

With machines using very fine, engraved depressions or fine, elevated ridges, like the shriner calendar rolls, to

[4] T. P. 211 Bureau of Mines; Coghill & Bonardi, Quantitative Microscopy of Powdered Ores.

produce modifications in the appearance of the material, the microscope has been used to note imperfections in manufacture or those subsequently caused by breakage, filling in of the spaces, etc.

In the operation of machines requiring fine adjustments, as tool lathes, a microscope has been employed to reduce the need for calipers. It is claimed that better accuracy is obtainable with less time consumed.

E—The Microscope Used in the Study and Comparison of Finished Materials

The study of finished products to learn their normal structure, composition and weaknesses, and to compare them with standard samples or with various methods of production, and to detect methods of treatment or to test their properties, has frequently been done. The changes in appearance or in composition, or their contamination, in handling and storage, can many times be observed through the microscope. See Figs. V, VI and VII.

F—The Microscope an Aid in Making Authentic Records

The opportunities for the use of the microscope in straight visual examination are frequent, but, if there be added to that the making of authentic and permanent records by taking photographs through the instrument, the total number is greatly increased. It often happens that the materials themselves can be seen with the eye plainly enough, but in making records it is better to use the microscope. The field is a highly special one technically called "photomicrography." The use of the records in buying, selling, comparing, instructing and in aiding the settling of disputes in and out of court, may be of great advantage. They show things as they are and leave little room for conjecture.

6—Summary

The microscope is seen, therefore, to possess great values in industrial work when used to its maximum possible extent in a given industry. While a large number of uses are on record and the necessary instructions for carrying out the tests and the needed information for interpreting what is shown in these cases are given, there are many other uses which as yet are in the hands of but few individuals. Other uses can also be recognized and employed if the necessary thought is put upon them to adapt the method and study and record the data. Much individual work is still to be done. From written descriptions it often seems as though the task is difficult and tedious, but very often it is, in reality, straightforward and simple. In view of its many diversified uses in connection with raw and finished materials, processes, machines, working operations and the making of records, and on account of the rapidity and economy in its operation, it is an instrument worthy of general, renewed interest and more searching endeavor to extend its application to industrial problems.

(*Part II will follow in the next issue.*)

BRAZILIAN DYESTUFFS

Brazil possesses almost an endless variety of vegetable dyes, ranging from deep black to the faintest yellow and rose. Its very name comes from the fiery red (braza) color of the pao Brazil, the Brazil wood of old-time commerce.

Indigo, locally known as anil, grows spontaneously throughout Brazil. It was cultivated extensively during the Colonial period, when thousands of tons found their way to Europe. To-day its cultivation has been practically abandoned, as the foreign demand has ceased. The plant still grows wild.

Pio cravo, found in all the States of the Republic, but most prevalent, apparently, in Espirito Santo, yields an intense black dye. It is extensively used in households throughout the intertior of Brazil for dyeing cotton cloth. A deep black dye is also obtained from a small tree—which furnishes a dark-hued coloring material used successfully in certain interior sections as a hair dye.

Anil assu yields a blue-black dye bark of the tree known as brauna, Maria preta, or grauna. The sap is very similar to that of real indigo. It is said to be easier to extract the dye from this variety than from real indigo. The plant is found in an abundance.

Anil trepador, or climbing indigo, which occurs in two varieties, produces a rich, blue dye, much used by the Indians. Brincos de Princeza, found in Minas Geraes, Rio de Janeiro, Bahia and Espirito Santo, yields a black dye; while a dye of inky blackness is obtained from the camarambaia, occurring in Bahia, Minas Geraes, Rio de Janeiro and Rio Grande de Sul. Fuchsia, abounding principally in Minas Geraes, also yields a black dye, as do negreira and macucu of maca de fogo.

The arariba yields both a yellow dye and a blood-red dye, used in cottage industry for coloring nets, hammocks and baskets. A red dye of exceptional fastness is obtained from the juices of the fructos de pacova found generally throughout Brazil. It is often used as a writing ink. Pao sangus, found generally throughout the Republic, and candua, a lichen occurring in the State of Minas Geraes, both furnish blood-red dyes.

Red dyes of various shades are also obtained from the catigua, sangue dedrago, urucurana, and both bark and wood of the tree known variously as roxinho, pao, roxo or guarubu. Carajura, or carajiru, a creeper abounding in the Amazonian regions of Brazil, is a favorite source of coloring matter from the juices of the plant. A decoction of the leaves deposits after boiling a fine red powder, which is regularly sold in the native markets.

From the root of the gravata de tingir is obtained a yellow dye used extensively by the Indians. It is present in quantities in the States of Rio de Janeiro, Espirito Santo, Miras Geraes, Alagoas and Caera. Yellow dyes are also taken from Cruz de Malta, such as tatagibo de brejo, tatagiba de espinbo and tatauba.

Piece Dyeing Woolens and Worsteds

Necessity for Co-operation Between Dyer and All Departments—"Blaming It on the Dyer"—A Simple Test for Working Qualities of a Color—Some Causes of Clouded Goods—Improper Scouring Methods—Impurities—Carbonizing Before Dyeing—Speed of Reels

By H. J. FISK

THE piece dyehouse has always had the experience of running smoothly for a time and then the word comes that the dyer is wanted up at the perch in the shipping room. We know well that it means the beginning of another polite (or otherwise) controversy that is going to reach every part of the mill before it is finally laid to rest.

The simplest complaint that can be made is that the goods are cloudy and streaked, and, of course, that must be the dyer's fault. The dyer takes account of the colors he is using, and if he finds by a laboratory test that the fault lies with the dye the matter is settled and the only question is why he didn't know that beforehand. It often happens that a dyer has been using a certain dye for years, allowing a purchasing agent in the office to obtain his supplies at the best possible price. One day he is visited by the representative of some new concern which is endeavoring to gain an outlet for its product. The price is attractive and the strength appears equal to the standard, so an order is placed and before he realizes it the dyer is using the new dye under conditions where it is perfectly satisfactory. One day, however, its use results in trouble and everybody finds out, to their amazement, that there was a deficiency in some respect that no one had ever considered—but the dyer gets the blame anyhow.

Test for Working Qualities

The best test for the general working qualities of any one color is to have a formula made up of three tried and proven dyes which will make a neutral gray. Say, for instance, we use Alizarine Saphirol, Fast Light Yellow 2G and Alizarine Rubinol in such proportion that they dyed a neutral gray. The color to be tested is substituted for its corresponding color in the mixture and it becomes very easy to note its relative leveling power, fastness, tone strength, etc. A simple laboratory test of a 1 or 2 per cent dyeing of any dye does not give us much valuable information, but the weak points become very evident when it is used in combinations.

Causes of Clouded Goods

It is seldom, however, that the dyer does not know the working qualities of the dyes he uses, and most of the complaints become real problems that need careful investigation as to the cause.

We may review a few of the causes that result in clouded goods, for when the cause is found the remedy is near at hand.

Variations in the wool composing either warp or filling will cause bars that follow the threads and are easily recognized.

Improper Scouring Methods

Scouring is perhaps the greatest cause of faulty dyeing. Scourers will use strong alkalies and excessive heat, because they feel that such means are necessary to clean the goods. Sometimes they are. The writer knows of a mill that insisted on using a mineral oil emulsion on their wool mixings because it was cheap and they could not be convinced that whatever they saved on oil was wasted many times over in scouring and dyeing costs. Oleic acid (red oil) and sulphonated oil make a very efficient emulsion that actually helps the scouring. The action of soda on the wool is such that if it does not actually harshen it and make it feel "haspy," it does alter its affinity for dye and may easily put the scoured piece in such a condition that the best leveling dyes ever known will give cloudy pieces. The dyer should note in a case of this kind whether the trouble is all on one piece or whether the entire set are the same. If several pieces on the set are good and others bad, it is not the dyer's fault, because if the dyer were at fault all would be the same.

Impurities in Goods

It is hardly necessary to comment on bad water, lime soap and other impurities that interfere with good dyeing, because so much has been written already. It may be suggested, however, that if the dyer suspects such causes he would do well to run the goods up to a boil in the kettle with 1 per cent of ammonia or 2 per cent sodium phosphate before dyeing. It will be surprising how much matter he is able to remove from goods that were sent to him as being clean.

Carbonizing Before Dyeing

Some few mills carbonize before dyeing—a very bad procedure, as there are many opportunities to alter the nature of the fibers and foster uneven dyeing. Carbonizing after dyeing seldom gives any trouble unless dyes have been used that are sensitive. Speck dyeing is a very prolific cause of streaks, particularly if the goods are left any time before drying. They should be

extracted and dried as soon as they leave the speck dye kettle.

In dyeing tricotines or other goods where the face of the goods is easily marred by overwork or friction, it is customary to "bag" them by sewing the selvedges together, with the face of the goods inside. This also prevents the lists from curling up into hard rolls that show light streaks with any dye that is inclined to work rapidly.

It is an open question whether it is better to charge the kettle fully with all the ingredients and slowly raise to a boil, or to omit the acid or chrome, or whatever determines the taking on of the color, and raise to near a boil and then feed the acid slowly. Good results are obtainable in both ways.

Speed of Reels

The speed of the reels is a factor. If the goods travel in rope form at a high speed there is tension which results in creases that tend to remain throughout the entire dyeing operation. With the proper speed the folds, falling in the back of the kettle, will open out more or less and allow every part of the goods to be outside at some time or another, and thus give a greater uniformity of contact with the dye liquor. Too slow speed will subject the lower layers to the action of the hot steam for too long a period, and at the critical stage, when the dye is just beginning to take on the fiber, this may easily cause clouds.

With after-chrome dyes it must be remembered that many of them develop rapidly, and we must avoid adding the chrome too fast or we shall overchrome some parts, while others will have a deficiency and a different color.

Washing must be thorough, because any trace of chrome or salts left in the goods may cause color changes in the finishing or sponging operations. The heat of drying will cause color changes in those parts of the goods where foreign materials are present. Heat will alter almost any color, but when the wool regains its normal moisture the shade generally comes back.

These few points will indicate the many possibilities of trouble arising in the dyehouse, and it is hoped it will show the necessity of co-operation with the dyer by all departments of the mill. Redyeing is something that nobody likes; the dyer resents it, the finisher objects to trying to do good work on redyed pieces, and the management deplores the extra cost and waste.

Sometimes they put all these problems up to the technical man of a dyestuff supply house; sometimes he is able to straighten matters out and sometimes not.

The Atriken Chemical Works, New Brunswick, N. J., has leased three buildings of the former plant of the Hewes & Phillips Iron Works, Orange Street, Newark, N. J., and will remove its factory to this location. Possession will be taken at once.

MOTH-PROOF WOOL

The following abstract published by the "Journal of the Textile Institute" supplements the report of U. S. Consul Wallace J. Young which appeared in The Reporter of January 30, 1922, page 100. It summarizes an article by E. Meckbach in "Textileberichte," 1921, **2**, 359 and 373:

A preparation named Eulan F. has been produced by a German company. It is an odorless powder, slightly soluble in water. Wool is saturated with a solution of 6 grams Eulan per liter, with the addition of 3 grams concentrated sulphuric acid; in the case of half-wool, formic acid is used, and after several hours well rinsed. The wool is not affected, and only a few colors are slightly changed, but may be corrected by after-treatment with ammonia. Frequent washing and even slight scouring with soap and tepid water fails to remove the protecting influence. Stronger scouring with warm alkalies has an adverse effect. In one test two tubes were filled with loose wool, one treated with Eulan and the other untreated: 50 moths' eggs were placed in each. After six months the untreated wool had completely disappeared, whereas the Eulan treated wool was intact.

TESTING DYES FOR COLORED PAPER

By B. K. Steadman

Assume that pink paper is being made with a known grade of Safranine with the known one. We weigh out equal amounts of these dyes and make each up to the same volume with distilled water. The amount of color in any given volume of water can then be easily calculated. Example—Suppose one quart of water contained 0.5 ounces of dye, then one ounce of water (liquid ounce) would contain 0.0156 ounces of dye. (One liquid quart equals 32 liquid ounces.)

Now, if the above paper is being made with 50 per cent rag stock and 50 per cent bleached sulphite and 16 ounces of Safranine are being used per 1,000 pounds of air dry stock; then to make laboratory samples on the same basis, we use one ounce rag stock one ounce sulphite (both air dry) and 0.002 ounces—or 0.057 grams—of dry color, or its equivalent in water. In the same manner the amounts of filler, mordants, etc., would be figured.

The stock is shaken in a fruit jar containing some water and small pebbles, or shot, and then transferred to a big bowl with a definite amount of water. The color, size, filler, etc., are added in the same order as on a mill run and all are then well mixed with an egg beater or something similar.

Some of the pulp is then poured on the edge of the Fourdrinier wire and covered with a piece of dry soda pulp (smooth side down) and run through the couch rolls, then through the first press rolls. It is dried by hand on one of the dryers and is finally calendered.

I have made numerous tests in the above manner, and have compared results with paper made in the

mill on a large scale. There is little difference between the shades of paper made in each case if equivalent amounts of the various dyestuff, mordants, etc., are used, and if proper precautions are taken.

To carry out the above test the following apparatus is necessary:

1. An accurate chemical balance.
2. Some porcelain cups or several glass beakers.
3. A small watch glass in which to weigh the samples of dye.
4. A large bowl.
5. Several graduated flasks (glass).
6. Several measuring graduates (a few pipettes would also be useful).—Dyer & Calico Printer.

Modern Views on Soap

Part II

Use of Soaps—Nature of Scouring Processes—Electrical Effects—Emulsions—Adsorption and Scouring—Amount of Soap Used in Scouring—Additions to Soap Baths

(*Continued from page* 113.)

By CHARLES F. GOLDTHWAIT

Chemist, Klearflax Linen Rug Company, Duluth, Minn.

The Use of Soaps

In the practical use of soaps the first property to interest us (aside from strength and price) is solubility. With a fatty acid and different bases the ammonia soap is the most soluble, although little used outside of softeners; the potash soap is next and the soda soap third. As an example, Matthews[5] states that potassium oleate is about two and one-half times as soluble as sodium oleate. Since solubility varies with temperature and other conditions, it is a somewhat difficult term to define. While we have already reviewed the matter of solubility from the more scientific standpoint, we believe that what is understood in practice by the term is something more like the ease with which a soap will mix with water to a suitable strength or consistency for the particular work in hand, and the ease or difficulty with which soap remaining in the treated goods can be removed by rinsing. Unless otherwise specified, our future use of the term solubility will be in this general sense.

The thickness or viscosity of soap solutions is another of the more obvious properties. It is primarily due to the fact that the soap colloids are heavily hydrated or solvated, in somewhat the same way that copper sulphate takes up crystal water and is present in solution as hydrated ions.

The value of a soap has always been associated with its lathering power but it appears that lathering is not a cause of the cleaning effect, although it is a parallel property and is an indication of what can be expected. Fischer[1] states, "The production of a foam is best accomplished when the soap is present in a medium concentration and when the resulting system is essentially a liquid hydrated colloid." Soaps in true solution lose their foaming qualities, nor is lathering shared by the harder gels. Soaps from the fatty acids from the middle of the series foam the easiest of all and do so at ordinary temperatures.

Nature of Scouring Process

Shorter[6] has given excellent interpretations of the scouring process and after briefly reviewing his work the necessary properties in the soaps can be better understood. First, it is necessary that the soap or other detergent solution wet the dirt rather than merely running away from it as water does from a greasy frying pan. The solution must next have a tendency to "lift" the dirt and carry it into suspension, and finally it must hold the first dirt while still further quantities are taken up from the material being scoured, so that the dirt or grease can be ultimately removed.

Soap helps water wet greasy surfaces or fibers by reducing the surface tension. All liquids have this property of surface tension and the more they have the less easily will they spread, as it acts like a rubber skin pulling any small amount of liquid toward the form of a drop. Mercury is an example at one end of the scale and the tension is sufficient to hold it as a globule; water has less tension and can spread to a thin layer while kerosene and other fluid oils can spread almost indefinitely. That is, as surface tension decreases the liquid tends to spread and wet more surface.

Wetting a piece of cloth involves three substances—cloth, air and water. If we have dry cloth and water separately there are two kinds of surfaces, one separating cloth and air and one, water and air. When wet, one kind of surface has disappeared and we have cloth and water with usually an extra amount of surface between

[1] Fischer. "Soaps and Proteins." Wiley, 1921.

[5] Matthews. "Bleaching and Related Processes." Chemical Catalog Co. 1921.

[6] Shorter. Articles on the scientific principles of scouring as published in the Journal of the Society of Dyers and Colourists, Textile Institute Journal, etc.

water and air. The process of wetting consists, therefore, of this change.

Each surface tends to contract because of its surface tension just as water tends toward drops, so there will be a struggle between the cloth-air tension on the one hand and the air-water and cloth-water tensions on the other. If the former, cloth-air tension, is greater than the sum of the other two the cloth will be wet; if less, it will not.

Substances of a greasy nature have a low surface tension and it is difficult to wet them. This, of course, includes the oil in any piece of fabric. In scouring, it is therefore necessary to add to the water something that will reduce the water-grease and water-air tensions. Soap lowers both; it thus assists in wetting the grease and allows emulsification to begin, followed by release of the dirt. Dirt particles might easily redeposit on a complex body like a piece of cloth but are kept from doing so by the Brownian motion.

Electrical Effects

While it is rather difficult to separate electrical effects very sharply from some of the other phenomena of colloid chemistry, according to Shorter, they have a rather special influence. If a piece of cloth is dipped into water it ordinarily acquires a negative electrical charge and the liquid assumes an equivalent positive charge. The fine dirt particles in a wash water are also charged negatively, and since like charges repel each other, there is a tendency toward preventing the particles from collecting together or coagulating, and from redepositing on the piece. The vigor of the Brownian motion depends on the smallness of the particles and this activity is assisted by the electrical charges.

The effectiveness of alkali in a scouring liquor is usually attributed to the formation of a soap either by neutralization of free fatty acid or by a slight saponification of neutral oils. While this is important and will receive its share of attention, the alkali has other valuable effects that must not be overlooked. Experiments have shown that the addition of small amounts of alkali to such aqueous suspensions increases this charge while acid diminished it. Therefore dilute alkali tends to stabilize a suspension while acid tends to coagulate it. Ordinary detergent solutions are always alkaline either by added alkali or hydrolysis alkali from the soap. This also tends to maintain the dirt and grease in suspension and to assist in the emulsification.

Emulsions

While definitions are a bit dry they serve to clarify matters and to reassure us that we are thinking about the same things in the same way. An emulsion is a suspension of fine particles of one liquid in another, as of fat globules in water. It does not properly include dirt suspensions, but according to Fischer a simple soap solution itself is or behaves very much like an emulsion. Since one of the principal factors in scouring is emulsification it should be thoroughly understood. The formation of an emulsion can be easily illustrated by shaking a little oil with water. It mixes in the form of very fine drops but separates out again rather quickly. We get an emulsion but it is not stable. By the addition, however, of certain substances to the water the effect can be modified in two ways: First, to prevent the coalescence of the oil droplets, and second, to cause the oil to be split up into much finer drops for the same degree of shaking. Some emulsifying agents produce both these effects and some only the first.

In getting at the cause of emulsification we come upon the important property of adsorption, not absorption, like a rag soaking up water, but adsorption—the rather mysterious property by which so many things cling in minute amounts to the surfaces of other things. For example, dyeing is largely adsorption of dye by fiber. So is the retention of acid by carbonized wool which may occur if goods are not very carefully neutralized. In a similar manner, dissolved materials tend to concentrate on liquid surfaces and assist in lowering the surface tension which in the case of water may be reduced to one-third by adding 2½ per cent of soap. This imparts a threefold ability to wet-out which may arise in two different ways from such adsorption. Soap from the solution may be adsorbed at the surface of contact of soap solution and greasy cloth, or an increased concentration of soap in this layer may result from the interaction of hydrolysis alkali in the solution with free fatty acid in the oil.[7]

Lathering power of soap is due to the "surface activity" of the soap solution against air and does not necessarily measure its "surface activity" against grease. Ordinary soaps, however, exhibit both effects and lathering power is some measure of the detergent power. It is possible, however, that a colloidal solution may be a good detergent and yet possess little ability to form a lather.

Adsorption and Scouring

Adsorption both helps and hinders in scouring. We have said that the colloidal nature of soap gives it a protective action which tends to hold fine dirt and grease in suspension. Here again is a case of adsorption. As soon as particles of dirt and droplets of oil are free in the solution they attract some form of soap from the solution to themselves forming an encircling film that keeps them from going back on the goods or coalescing into large groups. In other words, as we have already stated, the grease is emulsified and then the emulsion is rendered stable until it can be run off. If the dilution that accompanies rinsing is done carefully enough, very little of the matter that has been removed will go back to the fiber.

Adsorption appears still again, but this time in not so favorable a role. Much *dirt* seems to be fixed on textiles

[7] Shorter. J. S. D. C. April, 1916.

by adsorption and it is necessary that the soap take its place before it can be removed. The soap itself is then very difficult to remove and there is nearly always at least 1 per cent left in the goods, even under the very best conditions[8] of scouring and rinsing.

Amount of Soap

The amounts of soap to be used in scouring have been stated from the physical-chemical point of view, but it will be left for each reader to decide as to the correctness of these strengths. Judging by the surface tension effects, the best concentration is 0.4 to 0.5 per cent and this is stated to correspond roughly with practice in England.[9] In laundry work[8] the best results are claimed to be obtained with 0.2 to 0.4 per cent solution strength. Other statements run from 0.15 up to about 1 per cent. The proper soap strength depends on the kind of soap, also on the hardness of the water and the nature and dirtiness of the material.

In any kind of cleaning with soap it is considered necessary to have a permanent lather in order to be sure that the desired result is being obtained, whether the operation be washing dishes, shampooing the hair or scouring worsted pieces. It is customary also to add soap from time to time to reach or maintain this condition. Aside from loss of soap due to hardness of water or similar causes there is a familiar exhaustion of the soap bath by fouling. This can be explained on the general principles already stated.

Exhaustion of soap may be due to two causes.[9] The first is removal from solution through its adsorption on the goods as well as on the particles of grease and dirt. The main cause in scouring is fouling with grease and dirt, which by itself is not an explanation. Since exhausted scouring liquors still possess a fair degree of surface activity, fouling may mean that all that portion of the soap colloid which has the protective action, that is, which is adsorbed and helps keep the dirt in suspension, may have become used up. The property of lathering disappears at the same time. To all appearances the union of soap with dirt in the liquor takes precedence over the formation of foam at the surface until all the dirt has been taken care of.

Additions to Soap Baths

Other materials are frequently added to soaps used in scouring and as a rule they should be added at the mill where they can be controlled, rather than purchased as more or less doubtful mixtures.

Most widely used is soda ash, which has definite useful functions. It brings about the desired lowering of surface tension at less expense than by soap alone. Its other effects are similar to those where soda ash is used by itself. Theoretically, where there is any free fatty acid in the oil and any free alkali in the scouring bath they will combine and form a soap which will then be just as effective as if it had been bought as such and added to the liquor. Such a method of working means an economy as the oil serves two purposes.

A few special conditions must be fulfilled for practical success. In such scouring it is better to add the alkali slowly until enough soap is formed and *dissolved* to produce the stabilizing effect. Gradual addition of the alkali gives better emulsification and scouring. An oil must contain at least 30 per cent free fatty acid to scour off a piece with alkali alone. Naturally, red oil is the best for oiling wool that is to be scoured in this way. Perhaps no small factor is the effervescence of carbon dioxide at the surface of the goods.[11]

When pieces are scoured with alkali alone the emulsification is due to the formation, in the surface layers separating the solution from the oil on the piece, of a layer of soap by the interaction of the alkali and the free fatty acid in the oil. The stabilization of the emulsion is due to the passing into solution of the soap thus formed.

Added alkali tends to increase enormously the surface tension effect even against mineral oils, but it also tends, if its concentration exceeds a certain small amount, to diminish the stabilization effect. A compromise is usually adopted in the direction of sacrificing stabilizing effect to rapid initial emulsification.

If the alkali is too strong in proportion to the amount of soap present it will start to "salt" it out and there will be only curdy masses of soap at the end of the process with none in solution.

Some of these relations have been given in more definite figures.[12] No distinction appears to be made between cases using soda alone and those where soda ash is used in soap solutions and, in fact, after scouring has proceeded for a short time there is very little difference between them. Alkali equal to a 3 per cent solution is considered about the limit. It can be used where the wool oils contain large proportions of fatty acids. If the strength runs up to 3½ to 4 per cent (7 to 8 deg. Tw.) the soap remains largely on the pieces and does not exercise much scouring effect until the rinsing when the soda is removed and the soap dissolved. If down to 2 per cent, there is more likely to be a good lather and good scouring. The use of a weaker alkali and scouring in two stages is recommended for the more difficult cases.

An example is Schofield's[11] [12] multiple scouring process where the goods are run for a few minutes with soda ash and the liquor run down the drain without adding any rinsing water, then further alkali and soap solutions are added and the scouring completed. The superficial and heavier dirt comes off in the first operation and is at once removed from the sphere of action, then the more penetrated and embedded oils and dirt are removed in

[8] H. Hey. J. S. D. C. July, 1921. Page 184.
[9] Shorter. J. S. D. C. March, 1919. Page 56.
[8] One of the best recent discussions on the nature and properties of soap solutions is found in the Third Report on Colloid Chemistry of the B. A. A. S. 1920.

[11] Schofield. J. S. D. C. December, 1921. Page 300.
[12] Schofield. "Scouring and Milling." Netherwood, Dalton & Co. 1921
[13] Schofield. J. S. D. C. April, 1921. Discussion by Shorter, page 106.

the second stage of the process and the final scouring is accomplished in a cleaner liquor.

A very interesting experiment confirming some of the more recent research was performed by Jackson in 1907. Some very dirty linen fibers were enclosed in a cell containing water, under a microscope. Particles of dirt were seen to detach themselves and start vibrating in the water. When the water was replaced by soap, a larger number of particles broke away and vibration was more active. When the soap solution was replaced by salt, movement was almost completely stopped. By the same method a certain amount of alkali was seen to be helpful while an excess acted like salt in tending to retard the activity.

(To be concluded.)

The Chemical Constituents of Raw Cotton

By ROBERT GEORGE FARGHER, D.Sc., and JOHN CHARLES WITHERS, Ph.D.

The British Cotton Industry Research Association

[Note—Figures in parentheses refer to Bibliography on pp. 120 and 169.]

(Concluded from page 120.)

VII. The Proteins of Cotton

THE occurrence of nitrogen in cotton fiber seems to have been first mentioned by Schunck (4), whilst the presence of protein may be demonstrated by Haller's method (8). Our present knowledge is, however, rather of the disappearance of the nitrogen during extraction and bleaching than of the actual nitrogenous constituents.

Typical estimations of nitrogen are quoted by A. Schindler (37) as follows:

Egyptian, raw	0.250 - 0.256%
American, gray, yarn	0.138%
Texas, raw, cleaned	0.150%
Peruvian, red	0.280%

Action of solvents—Knecht (24) has examined the removal of nitrogenous constituents by extraction with a number of solvents, his results with an American cotton containing 0.204 per cent being as follows:

After Successive Extraction with	Nitrogen Content American %	Egyptian %
Benzene	0.189	0.240
Alcohol	0.184	0.226
Water	0.175	0.218
Ammonia (dilute)	0.175	0.218
Formic acid (dilute)	0.168	0.211
Hydrochloric acid (2 deg. Tw.)	0.138	0.175
Bleaching powder (2 deg. Tw.)	0.022	0.037

Treatment with inert solvents thus accounted for 14.1 and 16.7 per cent of the nitrogen in the respective complex, and chemical treatment for 72.3 and 71.3 per cent.

Role in dyeing—Knecht and Fernandez (26) have suggested that as an albuminoid has been obtained from raw cotton, dye affinity may be attributed to a definite substance, and in this connection it is worth recording that R. J. Flintoff (38) has discussed the function of added albuminoids as fixing agents in the dye bath. Haller (38a) has also shown that there is a substance in the cotton hair which has an affinity for stannous chloride.

VIII. Pectic Material

Schunck (4) isolated from amongst the products removed from cotton by the soda-ash boil considerable quantities of a substance corresponding with the *"parapectic acid"* described earlier by Fremy. More recently, Knecht (24) obtained a similar product from the caustic soda boil which had been previously lime-boiled and soured. The material so obtained has received little attention, and the considerable literature on such products which has accumulated during the last decade is concerned chiefly with the pectic substance of sugar beet and of fruit juices.

Pectose is probably closely allied to cellulose. Fellenberg (39) has suggested that it exists in unripe or barely ripe fruits as a product insoluble in water which is neither a calcium salt nor a glucoside derived from pectin. It is readily converted by cellulose extractives into pectin and pectic acid, and by fermentation with pectase into pectin (vegetable jelly), the chief constituent of Irish moss. This fermentation is an important process in the retting of fibers such as flax, *B. amylobacter* and *B. comesii* being regarded as the active agents.

Fellenberg states that pectose is probably converted into *pectin* in ripe or over-ripe fruits. The latter swells and dissolves in water, but the viscous solution soon sets to a jelly. Pectose is a reversible colloid, not coagulated by silver nitrate, mercuric chloride, barium chloride, or a number of other salts, and with extremely pure pectin there is no coagulation even with alcohol.

On treatment with warm dilute sodium hydroxide, pectin loses methyl alcohol and is converted into *pectic acid* which is very soluble in alkali hydroxides, carbonates, or phosphates, and in most ammonium salts of organic acids. Ammonium oxalate gives a limpid solution, but alkali carbonates give mucilages. Its solutions in water are

(Continued on page 164.)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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ARTHUR E. HIRST WILLIAM K. ROBBINS
WALTER M. SCOTT

FOURTH COUNCIL MEETING

The fourth meeting of the Council of the American Association of Textile Chemists and Colorists was held Friday, February 10, at the Engineers Club, Boston, Mass.

The following members were in attendance: Prof. L. A. Olney, William K. Robbins, George A. Moran, A. E. Hirst, William D. Livermore, William H. Cady, W. M. Scott, Winthrop C. Durfee and W. E. Hadley. E. C. Bertolet was unable to attend.

The minutes of the last meeting were called for, but the reading was omitted.

The matter of the incorporation of the Association was discussed, but it was decided to postpone such action until a later date.

The following applicants were duly admitted to membership in the Association in accordance with Article IV of the Constitution:

Active Members

Arey, Helen L., 96 Columbus Avenue, Salem, Mass.
Asst. to Chemist, Pacific Mills, Lawrence, Mass.

Arnzen, F. E., Fall River, Mass.
Supt. Plant No. 2, Fall River Bleachery.

Brownell, K. A., 11 Rutgers Place, Passaic, N. J.
Chief Chemist, Standard Bleachery Co.

Bannan, F. E., 1720 Washington Street, Wilmington, Del.
Dyestuff Demonstrator, Du Pont Co.

Burt, A. M., Rocky Mount, N. C.
Hosiery Manufacturing, Rocky Mount Hosiery Co.

Carter, Stewart F., 77 Lafayette Avenue, Passaic, N. J.
Textile Expert, J. Wolf & Co.

Currier, R. J., Box 178, Fulton, N. Y.
Supt. Dyeing, Fulton Mills, Fulton, N. Y.

Deady, William F., Box 158, Slatersville, R. I.
Foreman Dyer, Slatersville Finishing Co.

Forsdale, O. H., 57 Des Laurien Avenue, Webster, Mass.
Textile Chemist, S. Slater & Sons Co.

Estlow, J. W., Box 275, Schoolfield, Va.
Overseer Dyeing, Riverside & Dan River Cotton Mills, Inc.

Foss, W. C., Greenville, N. H.
Dyer, Columbian Mfg. Co.

Garnett, S. I., 12 Fort Avenue, Edgewood Station, Providence, R. I.
Calco Chemical Co., Boston, Mass.

Hannah, Jr., G. K., River Street, Fitchburg, Mass.
Textile Chemist, Parkhill Mfg. Co.

Hilton, W., Box 12, Apponaug, R. I.
Colorist, The Apponaug Co.

Le Portier, V. D., 220 West Street, Talladega, Ala.
Supt. Dyeing, Samoset Mills.

McKenzie, K. M., 66 Leonard Street, New York.
Converter Cotton Piece Goods.

O'Brien, Ruth, Ames, Iowa.
Asst. Prof. Tex. Chem., Iowa State College.

Proctor, B., 35 Everett Street, Arlington, Mass.
Chemist and Demonstrator, Kuttroff, Pickhardt & Co.

Sullivan, P. L., Rockingham, N. C.
Supt. Dye Works, Great Falls Mfg. Co.

Whittaker, F., Box 454, Magog, Quebec.
Works Chemist, Dominion Textile Co.

Wooffindale, W. H., 110 Grenada Terrace, Springfield, Mass.
Textile Chemist, Emerson Laboratory.

Zillensen, E. A., Belleville, N. J.
Manufacturing Chemist, Liberty By-Products Co.

Junior Members

Bamberger, L. L., Providence, R. I.
Plant Chemist, Silver Spring Plant, U. S. Finishing Co.

Blades, A. H., 592 Haverhill Street, Lawrence, Mass.
Color Mixer, Pacific Mills, Lawrence, Mass.

Brown, Jr., W. G., Lowell, Mass.
Student, Lowell Textile School.

Caya, F., Lowell, Mass.
Student, Lowell Textile School.
De Nuccio, P. P., 53 Oak Street, Lawrence, Mass.
Laboratory Asst., Pacific Mills, Lawrence, Mass.
Fernald, B. B., 14 Elgin Street, Providence, R. I.
Chemist, Imperial Printing Co.
Holly, T. K., Shawsheen Manor, Andover, Mass.
Asst. Color Mixer, Pacific Print Works, Lawrence, Mass.
Runnels, H. N., Lowell, Mass.
Student, Lowell Textile School.
Schwarz, H. L., Lowell, Mass.
Student, Lowell Textile School.
Southwick, C. H., Lowell, Mass.
Student, Lowell Textile School.
Symmes, D. W., 10 Madison Avenue, Winchester, Mass.
Student, Lowell Textile School.
Worthen, C. T., 267 Groveland Street, Haverhill, Mass.
Student, Lowell Textile School.

The Council discussed the advisability of accepting several of the applicants for membership, and the Secretary was instructed to communicate with these prospective members, in order to obtain more definite information regarding their qualifications.

The Secretary was authorized to immediately send out, in accordance with Article IV of the Constitution, all names of recent applicants for membership.

The meeting was then adjourned.

W. E. Hadley, Secretary.

NEW MEMBERS

In publishing the names of new members in the January 30 Proceedings the designation of business was not included, but as it was later considered desirable the list is herein reproduced with the addition of the business affiliation:

Active Members

Bromley, Frank, Box 128, Apponaug, R. I.
Supt. Color Dept., Apponaug Print Works.
Chantler, Ambrose R., 364 Potter Avenue, Providence, R. I.
Technical Demonstrator, Du Pont Co.
Dempster, William C., 644 Greenwich Street, New York, N. Y.
Demonstrator, A. Klipstein & Co.
Emmett, James R., 92 Windsor Road, Waban, Mass.
Demonstrator, Special Products Co., Boston, Mass.
Linberg, George O., 50 Belmont Avenue, Springfield, Mass.
Demonstrator, Newport Chemical Works, Passaic, N. J.
O'Brien, Edwin J., 2207 Dorchester Avenue, Dorchester, Mass.
Color Chemist, Standard Color Co., Boston, Mass.

Junior Members

Allen, Woodward, Room 72, 89 State Street, Boston, Mass.
Consulting Chemist, Solvay Process Co.
Laurin, Eric T., 40 Lundberg Street, Lowell, Mass.
Instructor, Lowell Textile School.

THIRD RESEARCH COMMITTEE MEETING

The third meeting of the Research Committee was held Friday, February 10, at 4 p. m., at the Engineers Club, Boston, Mass., the following members being present: Council, with the exception of E. C. Bertolet, and in addition William R. Moorhouse and W. J. Murray.

The reading of the minutes of the last meeting was called for, but the reading of same was omitted by unanimous consent.

A report was presented by a subcommittee appointed at last meeting to consider the necessary steps to be taken in formulating a proper procedure to be followed in designating fastness tests which can be considered as standard.

It was decided by the Committee that they would carefully consider the work already done by the "Second Open Conference of the Fastness Commission of the Section of Chemistry and Dyeing and the Textile Industry of the German Chemical Society," but at the same time would only hold to those sections of the report which are believed to be adapted to our needs, and make whatever alterations, revisions and additions as might be considered necessary.

It was decided that after a proper outline had been devised, considerable experimental work would have to be done before anything definite could actually be established as standard. It was felt that more time should be devoted to a further consideration of the subject, and the Subcommittee was continued until the next meeting. The Subcommittee suggested several schemes of procedure to be used in the testing of cotton material relative to fastness to washing, but it was decided not to publish them in the Proceedings until they could be presented in a more complete form, as provisional methods.

It was considered desirable, at this time, that committees should be appointed to establish fastness tests for use upon wool and also upon silk material, in order that no time should be lost in arriving at definite data in this regard.

William D. Livermore was chosen chairman of the Committee relative to the Fastness to Washing of Wool Materials, which was to include George D.

Moran and W. K. Robbins, and was authorized to add other members if thought desirable.

W. M. Scott was chosen chairman of the Committee relative to the Fastness to Washing of Silk Material, which was to include E. F. L. Lotte and such additional members as were thought necessary to work in co-operation.

It was decided that when sufficient progress had been made by the various committees upon cotton, wool and silk, the results would be published as provisional methods, and that after a reasonable time had elapsed the records could be considered as official.

W. E. Hadley, Secretary.

COLOR REACTIONS FOR THE IDENTIFICATION OF ANTHRACENE VAT DYES

By Wallace J. Murray

Contribution from the Laboratories of Arthur D. Little, Inc.

In identifying the dyes used on dyed cotton fabrics it is often necessary to test for the dyes belonging to the anthracene vat class. There are no simple, satisfactory tests for the members of this class described in the books on dye identification. Therefore, we attempted to find a reaction which would serve for their identification, and yet be simple enough for routine work. We have found a reaction which seems to meet these conditions satisfactorily.

When anthraquinone is reduced in alkaline solution the deep red salt of anthraquinol is formed. On acidification the yellow anthraquinol itself precipitates.

Since the anthracene vat dyes are derivatives of anthraquinone, it was thought that similar color reactions would be obtained on acidifying their leuco compounds.

This was tried out on eight typical anthracene vat colors, and the expected color reactions were obtained. They are given in the list at foot of this page.

The method used in carrying out these tests was as follows: A small sample of dyed yarn or fabric was reduced in a dilute sodium hydroxide solution with sodium hydrosulphite, heating if necessary. The solution was poured off and the yarn rinsed once with water. Great care must be taken to prevent reoxidation. The best method is to pour off the reducing solution, and squeeze the yarn in the bottom of the tube with a stirring rod. Then fill the tube with water, work the yarn with a rod, and pour off the water. It is best to use boiled water, cooled out of contact with the air, but this is not necessary. The reduced yarn is covered with water and acidified with hydrochloric acid, when the color change is observed. On adding caustic the color changes back.

These color reactions only take place satisfactorily when the dye is entirely in the form of the leuco compound; and this must be kept in mind in carrying out the tests.

An excess of hydrosulphite at the time of acidification interferes with the test and deposits free sulphur in the solution. Hence the need of rinsing. It would be difficult to remove this excess of hydrosulphite when working with the dyestuff in substance, hence it is preferable to apply this test to dyed fabrics rather than to the dyestuffs themselves. However, the reaction can be carried out on the solution of the leuco compound if desired.

Name of Dye	Color of Dyed Fabric	—Color of Dyed Fabric After Reduction— (Alkaline Solution)	(Acid Solution)
Ponsol Yellow	Yellow	Dark Blue	Olive-Green
Cibanone Yellow	Yellow	Brown	Yellow
Vat Yellow R	Yellow	Pale Grayish Brown	Yellow
Indanthrene Blue RS	Blue	Blue	Dark Purplish Blue
Indanthrene Blue GCD	Blue	Blue	Violet
Indanthrene Dark Blue BO	Blue	Dark Blue	Orange-Red
Ponsol Violet	Violet	Blue	Purple
Indanthrene Green B	Green	Blue	Red

MEETING OF RHODE ISLAND SECTION

The second meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held in the rooms of the Providence Engineering Society on Friday evening, February 17.

Mr. Culver for the Nominating Committee reported the following nominations for officers:

For Chairman—William H. Cady.
For Secretary—Frederick C. Cushing.
For Treasurer—Ben Verity.
For Sectional Committee—John G. Masson, Walter S. Williams, Roscoe L. Chase, H. F. Schwarz.

These persons were unanimously elected.

Robert Spurr Weston, Consulting Engineer, of Boston, gave a highly interesting talk on "Water Purification for Textile Purposes," illustrated by lantern slides. A lively discussion followed, and the meeting closed with a vote of thanks for the speaker. An abstract of Mr. Weston's talk will be published in the next issue.

OBITUARY

James L. Amsden, Chemist of the Rockland Finishing Co., Inc., Garnerville, N. Y., and one of the Charter Members of this Association, passed away on Saturday, February 11, at his late residence, 139 Hudson Avenue, Haverstraw, N. Y. He was ill but a few days, having contracted influenza, which developed into pneumonia. He is survived by a widow and two children, John, aged eight, and Hope, aged twelve years.

Mr. Amsden was born in Springfield, Mass., in 1878 and graduated from the Worcester Polytechnic Institute in 1900. He was a conscientious student and a man of wide experience in matters relating to textile chemistry and dyeing. His obvious qualifications led to his being elected a member of the first Council of the American Association of Textile Chemists and Colorists, and he had recently been assigned by that body the position of chairman of a committee to formulate plans for the determination of standard methods for testing the fastness to washing of dyed cotton fabrics. The Association feels that in the death of Mr. Amsden it has suffered a very severe loss.

NOTICE OF MEETINGS

The next meeting of the Council will be held Friday, March 10, at the Engineers Club, Boston, Mass., at 4 p. m.

A meeting of the Research Committee will be held at the same place at 4.30 p. m.

Special committees on research work will meet at 3 p. m.

Members wishing to bring any matters to the attention of these meetings will please communicate with either the President or the Secretary.

BIBLIOGRAPHY OF JOURNAL ARTICLES ON DYE FASTNESS COMPILED BY WALLACE J. MURRAY

(Concluded from last issue.)

Year	Journal and Date	Author	Title	Abstract
1916	Mitt. K. Mat. Prüf., 34, 153-6		Standards and Processes Established by the Echtheitskommission for Fastness	C. A., 11, 2963, J S. I., 36-590
1916	Chem. Weekblad, 13-1176	J. Straub	Testing Fastness of Gray Military Fabrics to Light	C. A., 11, 540
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1918	J. Soc. Dy. & Col., 34-185	A. Robson	A Method of Standardizing the Fastness of Colors to Light	C. A., 12, 2250
1918	Color Trade J., 3-267	E. W. Pierce	The Fastness of Dyestuffs to Light and Ultraviolet Exposure	C. A., 12, 2690
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1918	Color Tr. J., 3-242	Anon.	Rapid Testing of Dyes	C. A., 13, 2453
1920	U. S. Bur. Standards, Sci. P., 378-233	Coblenz, Kahler	New Spectropyrheliometer and Measurements of the Component Radiations from the Sun and from a Quartz-Mercury Vapor Lamp	C. A., 14, 2888
1920	Tex. Wld. J., 58-1685	J. Monnet	Fast Colors and Fugitive Colors	C. A., 15-5
1920	Am. Ds. Rep., 7, No. 15, II, 14	W. M. Scott	Standard Methods of Testing Dyestuffs	C. A., 15, 1219
1920	Am. Ds. Rep., 7, No. 19, II, 27	W. D. Livermore	Standard Dyestuff Tests	C. A., 15, 1220
1920	Am. Ds. Rep., 7, No. 23, Sec. 2, 26	L. P. Jolivet, Abs. by B. C. Heyman	Fastness to Washing	C. A., 15, 1402
1921	Am. Ds. Rep., 8, Sec. 2, 11	W. M. Scott	Fastness Requirements of Dyestuffs by the Silk Industry	C. A., 15, 2191
1921	Tex. Colorist, 43-537	Anon.	Tests for Fastness Devised by German Commission	C. A., 15, 3211
1921	Text. Colorist, 43-29	H. V. Gordon	Testing the Fastness of Dyed Colors to Light	C. A., 15, 2550

A FEW EXAMPLES OF TEXTBOOKS GIVING METHODS OF TESTING DYE FASTNESS

Year	Journal and Date	Title	Abstract	Author
1908	.....	Mohlan and Bucherer	Rarbenschemisches Praktikum	Ref.: Chap. 7 (P. 351-357)
1908	.....	Post	Chemisch-technischer Analyses	3 Ed. 2-1224
1911	.....	G. Lunge	Technical Methods of Chemical Analysis	Vol. II, Part II, (P. 944-948)
1912	.....	F. Eppendahl	Die Echtheitsbewegung und der Stand der Heutigen Faberei	.....
1914	(1920 Reprint)	G. Schultz	Farbstofftabellen (Methods of Dyeing and Testing Fastness All Mixed Up)	5th Ed. (P. XX to L 11)
1917	.....	Cain and Thorpe	The Synthetic Dyes	Ed. III, Chap. XXXII (P. 331-333)

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE DISTRIBUTION OF REPARATION COLORS

AFTER several weeks of silence following the claim that present or former German agents had influenced the U. S. Department of State to abrogate the agreement whereby the Textile Alliance was permitted to act as a central agency for the receipt and distribution of America's share of the reparation colors, a statement has at last been issued by that organization which clears up any misunderstanding as to what was in the mind of Albert M. Patterson, president, when he made his charges.

Before going any further, it may be as well to point out the fact that the Textile Alliance would do better to be still more frank and open. When its charges first appeared, The REPORTER contended that they called for concrete, substantiating evidence—which was conspicuous by its total absence at that time. The charges were apparently extremely serious, and if Mr. Patterson was not prepared to back them up, then he was bound to keep them out of the press, no matter how well grounded they were, until ready to do so in conclusive fashion. The view was held that the matter was public property, and that the people of the United States had a perfect right to demand the facts even if it became necessary to air them in the courts. In other words, the public should not be obliged to drag forth any evidence which might be available. It should appear spontaneously for the reason that the charges were not made reluctantly, as by one who had inadvertently allowed them to "leak out," but boldly and without the inducement of a strong outside demand. Yet after the charges were made there ensued a complete silence, and any attempts to elicit further information met with refusal.

The Alliance now says, in the statement which appears in full elsewhere in this issue:

"In October, 1919, and several times since, the Textile Alliance, Inc., without solicitation on its part, was requested by the Department of State to undertake—and it did undertake—the purchase and distribution of reparation dyes accruing to the United States.

"In October, 1921, a protest was filed with the Department of State against this arrangement by Messrs. Kuttroff, Pickhardt & Co., Inc., a New York corporation, owned and managed by American citizens of German birth, who formerly in their corporate or private capacities were agents of the Badische Anilin & Soda-Fabrik, one of the constituent members of the German dyestuff monopoly."

From which it appears, then, that the firm in question is presumably the "present or former agents of certain of the German manufacturers constituting the Interessen Gemeinschaft" whose "pressure" upon the U. S. Department of State caused that body to terminate its agreement with the Textile Alliance—the "present or former agents" mentioned by Mr. Patterson in his letter. And it is not with any unfriendly intention toward the Alliance, which has earned the thanks of American dye consumers by its capable performance of an important service, that we take occasion to point out that this supplementary statement is somewhat unsatisfactory as regards necessary detail. Like the former, it appears to say either too much or too little. Those concerned, as well as the public, will surely want to know upon what grounds Kuttroff, Pickhardt & Co. based their protest against the good offices of the Alliance in the purchase and distribution—on a non-profit basis—of reparation colors. More particularly will the public itself want to know what pressure, if any, was exerted upon the State Department by Kuttroff, Pickhardt & Co. in order to bring about the abrogation of the agreement. This last is the important issue, for, as previously stated by the Department, "there was no dissatisfaction with the work of the Alliance."

As a matter of fact, there is nothing particularly sensational in the whole affair, and that is why it would have been better for the Alliance to have said its say in full at the very beginning. To the public—hundreds of whom read the statement in the press—it would, however, shape up about like this: The Department of State cancels its agreement, declaring that there is no dissatisfaction with the Alliance and that it merely desires to be relieved of further financial responsibility in connection with the importation of reparation colors. So far, so good. Then the Alliance issues a statement, which is publicly printed, to the effect that the governmental decision was the result of pressure by present or former German agents. Without the balance of the story, that sounds serious enough to warrant at the very least a Congressional investigation—and that is why there should have been more detail given at the outset. Or at all events, so it seems to many.

There was probably no "pressure" of any kind brought to bear, or even "influence." To declare that German agents could exert pressure enough to make Uncle Sam yield a point against one of his own industries is rather more of a strain than the average credulity can stand. Such a declaration was distinctly unfortunate, but it is

now past, and therefore may as well be forgotten.

Meanwhile, the Alliance avers that the State Department issued letters to Kuttroff, Pickhardt & Co., "and to other representatives of the German dye monopoly," informing them that the Department has no objection to the Reparations Commission allocating reparation colors to them. And it further believes that "if the allocations be divided among profit seeking corporations, connected or formerly connected with the German monopoly, the effect will inevitably be to re-establish the control, not only of reparation dyes, but of all German dyes, in the hands of the German monopoly or those representing it."

In the light of all these various revelations and contentions, it would appear as though several changes might be made in the manner of handling reparation colors. But these changes need not necessarily be radical ones. The statements herein recorded, and others which were previously printed in the form of resolutions, show that there is a wide-spread demand among dye consumers to have the Alliance continue to handle the reparations imports, and to this the State Department has no objection whatever. On the other hand, distribution of these colors by the Alliance may logically be objected to by other importers and dye agents on the ground that it brings a non-profit organization directly into competition with legitimate business, and further that it results in the creation of an efficient distributing organization which might conceivably be acquired, intact, by some individual firm among them at some future time. In other words, the dye dealers rightly insist upon their privilege to carry on their business of selling without being obliged to compete with what was virtually the Government.

It has always been the contention of The Reporter, in connection with all dye protection problems, that in cases of this kind there is invariably a way out which need injure neither side. And so it is in the present instance. The Alliance calls attention to the fact that the Reparations Commission is holding up America's share pending the designation by the Department of State of some central receiving body, and that if this continues the United States may be deprived of a portion of its just due. The Alliance does not seek to continue this work, and would prefer to see it in charge of some Government body; but since there appears to be no Government body willing or financially able to undertake it, then let the State Department notify the Reparations Commission that it may continue to consign the United States colors to the Alliance as heretofore. The nature of the business demands a central receiving organization, but let its functions stop right there, and all further responsibility as a distributor cease. Distribution could then be effected through the various agents already designated by the State Department, and such other reputable firms which it may see fit to designate. These can purchase of the Alliance at cost, and thereafter all competition will be on an equitable basis. A non-profit organization will receive the colors, but the unjust competition of such an organization will be removed from the distributing field.

And if the Textile Alliance is to continue as the sole authorized importing body for Reparation colors—as seems wisest to us—there is one change in the activities of this organization which ought to be effected immediately. This is the entire segregation of the Textile Alliance and the Dye Advisory Committee—the body which licenses dye importations. Consumers as a whole feel that the Dye Advisory Committee should act solely in a judicial capacity and should have no slightest connection with any organization which actually handles dyestuffs. A complete segregation of these two quasi-governmental bodies would go far towards restoring approval of our dye-licensing and reparation-importing machinery in the eyes of dyestuff consumers.

This would appear to be the best way out of the present situation, which, as the Alliance rightly maintains, calls for speedy action of some sort. Manifestly, if any and all dye dealers, reputable or otherwise, were allowed to make separate contracts with the Reparations Commission, there would be no sure and easy way of checking up on importations, and further, it is believed by many that we should shortly have a return of the conditions which prevailed in the early years of the war, when the dye "gyp" was rampant and adulterations and a multitude of other irregularities were so prevalent as almost to destroy the last vestige of confidence possessed by American dye consumers. Such a chaos is not desired again, and the present scheme offers advantages which would prevent it while satisfying all parties having to do with reparation colors.

AN ILL-TIMED DEMAND

HAVING progressed from comparative quiet and an entire absence of rowdyism, the New England textile strike, involving some 45,000 workers, which began two weeks ago, had attained, at the present writing, the apparently inevitable stages involving stonings, shootings, the calling out of troops and the employment of riot guns in an effort to quell disturbances. Violence, always foolish and ineffectual in proceedings of this kind, has gained the ascendency, serving still further to alienate public sympathy with the demands of the strikers.

For although many undeniably just strikes, designed to do away with real abuses or to relieve intolerable working conditions, have been staged in the past, the real issue of the present outbreak as revealed by a geographical survey of its centers is far from such. Rhode Island and New Hampshire are affected, whereas in Massachusetts the only city touched was Lowell, where 2,600 employees of the Hamilton Mills and the Bay State Cotton Corporation went out on the first day. The former mill closed down, but the latter resumed operations with enough men to justify remaining open.

Workers in all three States received a twenty per cent cut in wages. In Massachusetts the cut was actually a full twenty per cent, whereas in New Hampshire and Rhode Island it would in reality have

amounted to about ten per cent because of the accompanying increase from the forty-eight-hour to the fifty-four-hour week. Yet it was in New Hampshire and Rhode Island that the workers struck, while those in Massachusetts accepted their twenty per cent cut and stayed on the job.

Shortly before the strike occurred, Massachusetts passed a forty-eight-hour law, thereby making it impossible for employers to mitigate the wage cut as was the case in neighboring States. The real point at issue, then, is not money, but time spent at work.

In Somerworth, for instance, one of the principal storm centers of New Hampshire, there were 150,000 yards of cloth lying partly finished in the vats of the Great Falls Bleachery on the opening day of the strike. During a conference between Superintendent Hayes of the bleachery and Horace A. Riviere, of the United Textile Workers of America, the latter stated that men would be sent in to complete the cloth-finishing process provided they were allowed to do so on the forty-eight-hour schedule and at the old wage rate. The mill man rejoined that employees would not be allowed to enter the mill for this purpose upon such terms, since there were enough men in the executive departments to put the cloth through.

Othr instances might be cited, but this serves as well as any to show that what the men were chiefly interested in was in getting more leisure rather than more money.

Undoubtedly the workers have chosen a bad time to take a stand of this sort. The demand of the steel men for the elimination of the twelve-hour shift, with periodic twenty-four-hour shifts when changing from night to day, is vastly different, since this has been proved to be positively detrimental to the health and efficiency of the worker. But no question of breaking down under prolonged toil enters into the textile situation. Moreover, this country is still busily engaged in recovering from the effects of a wasteful war, and the trend of thought in all quarters is toward increased production as among the means for accomplishing this.

It is an old law, but a true one, that a worker can buy with his day's wages only what some other worker produces in a day, and sooner or later, when labor tries to get something for nothing, it sees this economic principle demonstrated afresh. It is entirely safe to say that any executive in the textile industry puts in an average of at least nine hours a day or better, and there need be no cry of an unjust distribution of the burden in the present case. If for no other reason than that the country as a whole needs his products, a man surely ought not to object to adding an hour a day to his eight-hour schedule, particularly when he can earn more money by doing so.

AMUSING, PERHAPS, BUT NOT IMPORTANT

OF more than passing interest to Americans is the recent conviction at Ludwigshafen, Germany, of Dr. Paul Kappelmeier, a dye chemist in the employ of the Hoechster Farbwerke, on a charge of selling manufacturing secrets to the Du Ponts. Kappelmeier was fined 50,000 marks and sentenced to nine months' imprisonment, while Dr. Albert Sander, indicted on a similar charge, was acquitted.

Just what value was placed by the Hoechster works upon the trade secrets thus disclosed is not made clear by reports reaching this side of the water. But it is fairly evident that they were considered important, judging from the amount of the fine and the length of the sentence. Also, whatever immediate harm such disclosures can do to the German dye industry as a whole, since its ability to market products here is strictly limited and it is able to undersell American manufacturers in foreign markets, is bound to be problematical for some time to come. It is somewhat doubtful whether the actual damage suffered will be great, owing to the inherent power of the organization of which the Hoechster concern is a member. The sentiments and motives actuating the prosecution and disposal of the Kappelmeier case appear rather to have been based upon principle, and to indicate, therefore, that the Cartel has by no means abandoned hope that it will some day again control American dye markets. Indeed, the very phrase coined by the Germans to describe that class of offense, namely, "economic treason," shows how seriously they continue to regard their chances of regaining former dominance.

It was charged by the prosecution at the trial of the two men that a Dr. Kunze, of Zurich, had acted as intermediary between Kappelmeier and the Du Ponts for the transfer of information which the former was in a position to obtain as director of research for the Hoechster company. It was stated that he sent to the United States a complete list of the composition of all dyes manufactured by his own plant, and that while he was negotiating with Kunze he was also in touch with another American dye factory with a view of obtaining a position with it.

It is difficult to express in cold type some of the subtler mental reactions induced by affairs such as the present one and the importation of German dye chemists for service in American plants—reactions experienced by many in the trade which are wholly apart and aside from the morals or ethics involved. Denounce the latter, if you will, and condemn the practice on principle; nevertheless it is undeniable by all save a few fungi that these cases, when viewed in another light, produce a certain feeling of amusement. We have been so overwhelmingly impressed by the utter impregnability of the Cartel—an impregnability supposedly based upon something beyond mere financial returns or even lifelong training—a something which was believed to extend clear down into the heart of Germany's national pride and which was deemed stronger almost than love of life itself—that it is difficult to repress a smile when one of its own henchmen tries to "sell out," thereby demonstrating anew the old saying about rats leaving a sinking ship. It is the

always-potent contrast of the sublime and the ridiculous which begets this smile. Likewise it reveals that the mighty god of Mammon can still find plenty of devotees among the professed scornful when hard times become his allies. Most of all does it show once more, and in striking fashion, that the Germans are just as far from being supermen, scientifically, morally or in any other way, as are the rest of us, who never made any pretensions of this kind. The spectacle of one of these "supermen" being arrested and brought back to Coblenz for trying to accept a position with an American firm, and of another flying pell-mell across the Holland border into Belgium with German and Dutch secret-service men in full cry behind him, is something well calculated to upset the gravity of ordinary mortals. When it is placed side by side with some of the propaganda which was rife here before and during the early years of the war, we are disposed to believe that readers will agree with us that it is, in plain English, funny, and, further, that it is little more.

Do not, we would urge some who are given to viewing molehills as mountains, attach undue significance to the Kappelmeier conviction. Its importance can scarcely be *under*estimated. When American dye manufacturers first began hiring German chemists to come over here and help shorten manufacturing processes and to save unnecessary research work, there was something of an outcry in certain quarters. American housewives would be "humiliated," the trade was assured, if they were obliged to wear apparel sullied by contact with the producers of poison gas. Yet the importation of reparation and other colors coming direct from the very factories and, perhaps, the very machinery which once turned out these late examples of schecklichkeit, went steadily on—as it properly should in cases where American manufacturers could not supply the needed products—and American housewives have suffered both proceedings without protesting. It will be readily enough conceded that conditions would be far nearer the ideal if we could manage to get along without either German colors or chemists, and thus become truly self-contained as regards coal-tar chemicals in general; but we formerly held and still hold it to be inconsistent to connive at the importation of German dyestuffs while condemning the importation of German dye makers. Any stigma which attaches to one must inevitably fall upon the other, and since the time has not yet come to make a clean sweep, why not, then, take advantage of every opportunity to shorten the interim? The importation of German colors advances the American industry not at all along the road to greater independence, whereas the presence here of German technical men does.

The REPORTER had no part in the former outcry, nor does it believe the present case worthy of much attention. It may be adjudged immoral to corrupt German technical men with American gold, but at all events it is certainly no worse than the corruption of American dyers by Germany which was allowed to continue for years without a murmur. Persistently denied a chance to work out their own salvation by the normal route, American dye makers cannot be severely censured if they are disposed to fight the devil with fire, and if any party to such transactions chances to run afoul of the law on either side of the water, that is distinctly his own affair and his own loss. We do not believe that the present instance need be "viewed with alarm" nor magnified into any greater importance than a calm consideration of the facts would indicate.

THE CHEMICAL CONSTITUENTS OF RAW COTTON

(*Continued from page* 156.)

flocculated by the addition of salts More prolonged action of alkali leads to *metapectic acid,* the ultimate product of the action of the usual bleaching agents. Pectic substances are almost entirely removed from the fiber in the scouring operations, which probably affect (40) the decomposition of metallic salts. In a recent process, it is proposed to eliminate pectic matter by the use of hot hydrochloric acid; it is claimed that the fiber is not seriously weakened by the treatment.

Methods for the extraction of pectin substances from plants have been elaborated by Bourquelot and Herissey (41), Wilhelmi (42), Schryver and Haynes (43), van der Linden (44), Hunt (45), and Caldwell (46), and means for their estimation by Fellenberg (47) and Koydl and Stros (48). The constitution of pectin has received attention from Weisberg (49), F. Ehrlich (50), pectin of the cell-membranes of plants is the calcium- and Gartner (51). Ehrlich's work indicates that the magnesium salt of a complex anhydro-arabino-galactose-methoxy-tetragalacturonic acid. There is no evidence as to the mode of linking, save that the arabinose group is weakly and the galactose group strongly held. Gartner considers that pectic acid is a galactose-galacturonic acid, rather than a tetragalacturonic acid.

IX. Coloring Matters

Little is known of the substances occasioning the color of the cotton hair. Penot (1) observed that the coloring matter is soluble in alkalis, but not immediately, air and light, or chlorine, being necessary for its complete removal. Schunck (4) and Knecht (24) have isolated highly-colored products containing nitrogen to which they are inclined to ascribe the color, but the conditions under which they were obtained—by soda-ash and caustic soda boils respectively—together with the analyses recorded by Schunck, render it probable that they are decomposed proteins. Still, it is possible that the coloring matter may occur in combination with protein. Taylor (52) has noted that the coloring matter present in cotton is eliminated completely by the use of a hypochlorite, together with hypochlorous acid or chlorine, but not by chlorine, hypochlorous acid, or a hypochlorite alone, and has drawn the conclusion that two coloring matters are present.

The pigment of cotton is most pronounced in wild varieties, the hairs of which are more or less colored by a reddish endochrome, especially in the parts more exposed to light. The color deepens as the cotton ripens, and W. L. Balls (53) states that a profound change occurs at about the 27th day of the development of the boll. The young bolls "pickle" in a mixture of alcohol and acetic acid to a green color, but the older bolls give a pink or bright red "pickle," and later, when the fruit is beginning to burst, the "pickle" is brown. The color is increased by exposure to diffused light, but is often destroyed by sunlight, especially when the protoplasm is dead. It is also deepened by steaming (54).

In a recent communication (55), Brabham states that cottons varying in color from light green to dark brown have been cultivated. The fibers are extremely fine, and the brown variety is stated to surpass in fineness any cotton hitherto produced.

The pigment is found chiefly in the lumen, but is also in association with the cellulose. Brazilian and South American cottons contain very little, but Egyptian cotton is so much richer in pigment that it can be readily distinguished thereby.

It is not known whether the pigment bears any relation to the "gossypol" of cotton seed (56) or to the glucosides found by A. G. Perkin (57) in cotton flowers.

X. Cellulose

The scope of this report includes only analytical procedure with regard to cellulose and its modifications. An excellent review of the subject has been made by J. F. Briggs (58), in which it is pointed out that many of the older methods, especially those of agricultural chemistry, merely indicate the proportion of ultimate fiber in the material examined, whereas a process is required which will isolate the realizable cellulose, reasonably unimpaired. That is, substances like lignin must be removed without altering the cellulose. For this purpose, Cross and Bevan's process receives the greatest measure of support, the lignin being destroyed by the action of chlorine. Waxes and other extractives may be removed either by means of sodium hydroxide or by extraction with benzene and alcohol. In a recent modification of Cross and Bevan's method (59) the material, after extraction, is treated alternately with chlorine and sodium sulphite.

In the case of highly lignified material, the alternative process of dissolving the cellulose and leaving the lignin may be employed. Digestion with fuming hydrochloric acid is recommended by Willstaetter and Zechmeister (60).

Cellulose undergoes change very readily, the chief modifications being (*a*) hydration, now regarded as an absorption phenomenon of the colloid cellulose, (*b*) oxidation, (*c*) acid hydrolysis, and (*d*) "depolymerization." The first modification is roughly estimated by means of the absorptive power of the material, under empirical conditions, for iodine (61), substantive dyes (62), cupric hydroxide from Fehling's solution (63), or sodium hydroxide (64). Another approximate method for ascertaining the extent to which cellulose is "modified" is to determine its solubility in sodium hydroxide, Schwalbe (65) using a 5 per cent and Jentgen (66) a 17.5 per cent solution. The process is employed mainly in distinguishing various types of artificial silks. The most important clues to "modification" are afforded, however, by determining (*a*) the "copper number" (67), that is, the number of grams of copper reduced from Fehling's solution by 100 grams of the cellulose, the value being below 1 for purest bleached cotton and rising to as much as 16 in the case of oxidized cellulose, and (*b*) the viscosity in ammoniacal cupric hydroxide solutions. The latter method has been investigated very thoroughly in the Research Department, Woolwich Arsenal (68), where it has proved successful, after recognizing that bright light and air must be excluded from the solution, that the cuprammonium solution must be fairly constant, and that the "falling sphere" viscometer is the most convenient measuring instrument. It is found that cotton treated with alkali hydroxides gives much less viscous solutions in "cuprammonium" than untreated cotton, and that the viscosity of nitrated cottons (in mixtures of alcohol and ether) varies according to the viscosity of solutions of the original cotton. Nitrated raw cotton gives the most viscous solutions, which fact suggests that the action of sodium hydroxide may be of the nature of "depolymerization."

In connection with the estimation of cellulose, the "drying to constant weight" is important. Most authorities agree that "dry" cellulose is obtained by heating to constant weight at 105 deg. Cent., and 105 to 110 deg. Cent. is the temperature employed in most of the Continental conditioning houses, although the Testing House of the Manchester Chamber of Commerce uses 100 deg. Cent. Briggs (58) suggests, as an alternative, drying in a vacuum over phosphoric anhydride, and drying over sulphuric acid under similar conditions has also been employed. Schwalbe (69) proposed the determination of "water of hydration," as distinct from "hygroscopic water" by distillation with toluene, the difference between the toluene method and the normal "drying" giving the "water hydration." Later, however, (70) he found that the toluene method only estimated "hygroscopic" moisture. The question of the accurate determination of moisture has also been considered by Schmansky (71) and by Nelson and Hulett (72). The latter observers heat the cotton in a very high vacuum and condense the moisture in a receiver cooled with solid carbon dioxide. They have adapted the method to the determination of the temperature at which decomposition sets in and the rate of decomposition. The relations between cotton and water will, however, form the subject of a special review.

The practice of washing with alcohol before drying seems to be objectionable, for both Renker (73) and Briggs (58) report that cellulose obstinately retains alcohol which cannot be removed by heat.

Any attempt to review the properties of cellulose would at once open one of the largest chapters in organic and

applied chemistry, but reference may be made, in conclusion, to an excellent summary of the reactions of cellulose and their application in the establishment of its chemical constitution recently published by H. Hibbert (74).

XI. Behavior of the Minor Constituents of Raw Cotton in Technical Operations

The literature of cotton spinning, manufacturing, and finishing contains an enormous number of references to the behavior of the ash, wax, protein, and pigments of raw cotton in these technical operations. The following notes may be regarded as typical of the information which is obtainable from such sources:

A—Spinning

Effect of the Wax in Spinning—It is generally agreed that at the customary temperature of the spinning mill the waxes in the fiber become soft and semi-liquid, and thus allow the proper working of the cotton. After spinning, the oil sets and cements the fibers. Spinning trials of Egyptian cotton deprived of its wax (22) showed that the material behaves very badly in the drawing and spinning processes, giving an excessive amount of waste, irregular results, and showing a tendency to adhere to the rollers. Finer counts give great trouble, and breakages are extremely frequent. In the loom, as warp, it is equally troublesome. Extraction with benzene after spinning, however, increases the strength, but diminishes the elongation of the yarn, as shown in the following table:

	American	Egyptian
	%	%
Increase in strength	12.4	11.0
Decrease in elongation	4.0	9.9
Average counts before	56.8	58.1
Average counts after	58.2	58.9

The strength tests are the average of 100 measurements.

The addition of 2 per cent of paraffin wax to the extracted yarn decreases its tensile strength by 33 per cent. Yarn spun from extracted cotton is from 24.5 to 27 per cent weaker than that from normal cotton.

B—Scouring and Bleaching

Losses During Bleaching—It is usually stated that cotton yarn loses from 5 to 7 per cent of its weight during bleaching, the figure for cloth being larger by the amount of material added during sizing. Jecusco (75), for example, states that American cotton yarn on boiling with 3 per cent caustic soda and 2 per cent sulphated oil at 15 pounds for 8 hours loses 6.45 per cent, the loss increasing to 7.3 per cent on full bleaching. Using soda-ash instead of caustic soda and following with a stronger hypochlorite solution, the loss in weight was 7.1 per cent. Trotman and Pentecost (76) point out the necessity of considering the moisture present before and after bleaching in working out figures of this kind. In a number of carefully conducted laboratory experiments, the following figures were obtained for the loss during the soda boil:

Reputed Count	Loss %	Number of Tests
24/2 American	5.30	7
32/2 American	4.01	36
40/2 American	4.35	15
70/2 American	3.90	29
70/2 Egyptian	6.54	8
80/2 Egyptian	4.59	12
100/2 Egyptian	4.35	18
120/2 Egyptian	4.60	12
150/2 Egyptian	4.55	6

The comparative effect of a number of reagents on the same cotton under standard conditions were found by Trotman and Pentecost to be as follows:

Reagent	Loss %
Potassium hydroxide	5.00
Sodium hydroxide	4.40
Sodium carbonate	3.70
Sodium borate	2.80
Sodium silicate	2.40

Removal of Mineral Matter During Bleaching—The mineral matter is speedily, but not completely, eliminated during the usual bleaching operations, the total loss at each stage being given by Hebden (77) as follows:

Steep	1st Boil	2nd Boil	Chemic	Sour
%	%	%	%	%
70.5	87.3	95.4	93.0	95.0

Knecht (24) reports that after lime boil, sour, soda boil, sour, chemic and sour HCl, the ash of a soft twist Egyptian sample had decreased from 0.89 to 0.15 per cent.

Removal of the Wax in Bleaching—The removal of the wax is one of the principal objects of the lime and soda boils, and their relative efficiency has been largely debated. It appears to be generally conceded that, as a single operation, the soda boil has the greater effect, as indicated, for example, by the following table (78), the figures being the percentages of ash, etc., left in the fiber:

	Expt. I		Expt. II		Expt. III	
	Soda Boil	Lime Boil	Soda Boil	Lime Boil	Soda Boil	Lime Boil
Ash	0.26	0.52	0.26	0.50	0.42	0.56
Free fat	0.10	0.26	0.20	0.15	0.16	0.11
Fatty acids (as soap)	0.16	0.22	0.13	0.21	0.26	0.56
Nitrogen	0.05	0.07	....	....	0.07	0.07

It is when the lime boil is considered in relation to the lime-sour-soda-sour sequence that opinions differ. Both Higgins (79) and Trotman and Pentecost (76) agree that in the lime boil the saponifiable portion of the wax is hydrolyzed and that the subsequent souring converts the insoluble soaps left on the fiber into free acids, which remain in close contact with the unsaponifiable matter, so that in the lye boil a soap is produced and rapid emulsification and elimination of the unsaponifiable matter result. The latter authors consider, however, that this result is achieved equally well by the direct soda boil.

The suggested mechanism of the lime boil is supported by the experiments of S. A. Shorter (80) and of Scheurer and Wallach (81) on the emulsification of mixtures of saponifiable and unsaponifiable oils. Higgins (82) quotes the following figures, obtained in the treatment of hanks of linen yarn:

Treatment	Decrease Weight %	Wax Remaining %
Lime, lye, lye	21.8	0.060
Lye, lime, lye	....	0.046
Lye, lye, lye	....	0.160

Hebden (77) indicates that the removal of fats and waxes soluble in ether during the soda boil takes place as follows:

Steep %	1st Boil %	2nd Boil %	Chemic %	Sour %
5.5	20.4	64.0	67.8	69.6

Trotman and Pentecost (76) give the following typical analyses to indicate the difference between good and bad soda boils of cotton goods:

	After Good Boil %	After Bad Boil %
Mineral matter	0.05–0.75	1.00
Free fat	0.10–0.15	0.35–0.70
Fat as soap	trace	0.25–0.50
Nitrogen	0.05–0.10	0.25–0.35

They emphasise the utility of sodium carbonate and of borax as emulsifying agents, but consider that the scouring effect of sodium silicate is offset by possible mechanical damage due to the deposit of silica on the fiber. Other suggestions for the more effective removal of waxes include the use of (*a*) a soap solution containing benzene (83), (*b*) a mixture of potash soap, carbon disulphide and olein (84), (*c*) resin soaps, (*d*) benzene and other solvents brought into emulsion with Turkey-red oil, and (*e*) Turkey-red oil and oleic acid (85).

Knecht (23) considers it improbable that cotton wax is saponified under normal bleaching conditions, the wax being only partially removed, and then by emulsification. He quotes the following figures in support of the statement:

Scouring Agent	Time	Wax Removed %
Soda ash, 4 deg. Tw.	4 hrs.	30
Sodium hydroxide, 2 deg. Tw.	4 hrs.	28
NaOH, 2 deg. plus Marseilles soap (5 per cent of weight of cotton)	25 mins.	45
NaOH, 2 deg. plus Marseilles soap (5 per cent of weight of cotton)	4 hrs.	64
NaOH, 2 deg. Tw. plus resin soap (5 per cent of weight of cotton)	25 mins.	73

Although the use of resin soap appears to be so effective, it has been suggested that if the water used contains lime or magnesia, resinates may be precipitated on the fiber and eventually produce a brown color (86). The efficacy of potassium hydroxide compared with sodium hydroxide (76) and of strontia in relation to lime (87) has been considered. Potassium hydroxide is said to remove 20 per cent more wax when used in equimolecular proportion for the same time, whilst strontia is supposed to exert a saponifying action three times as great as that of lime and to give a superior general bleaching effect. There is, however, the possibility of tendering, due to oxidation.

The retarding effect of neutral salts and of hard water on the soda "boil" is considered by Trotman in a later communication (88). The same writer (89) points out that wax retained after boiling may protect the cotton from the action of the "chemic," whilst Graf (90) considers that the reducing agents present in the wax cause the "bleeding" of vat colors in the lye boil, and indicates methods of overcoming this. Kollman (91) has studied the fall in reducing power of raw cotton in the course of the bleaching process, the greatest change taking place after the lye "boil," when the majority of the secondary constituents are removed. Whether the "yellowing" of goods in storage is due in some measure to the wax appears to be undecided, Levine (37), Crowther (92), and Higgins (93) favoring this assumption, whereas Erban (94), Hebden and Freiberger (95) are of the contrary opinion.

In bleaching, cotton from which the wax has been previously removed yields a "white" much superior to the untreated cotton (23).

In all the more recent literature (78-95), an important series of experiments by A. Scheurer (96) appears to have been overlooked. Scheurer studied the saponifi-

cation of tallow, cottonseed oil, and the fatty constituents of raw cotton in contact with cotton cloh, and came to the following conclusions (1) Sodium hydroxide is twice as effective as sodium carbonate in equivalent concentration: increasing the concentration of alkali from 5 to 10 parts per 1,000 is without sensible effect; (2) mixtures of sodium hydroxide and sodium carbonate show maximum efficiency when the proportion of carbonate is equivalent to 25 per cent of the total alkali, an effect which is ascribed to the mechanical properties of the solution; (3) the addition of rosin increases the velocity of saponification, which is still further enhanced by increasing the concentration of the alkali; (4) the saponification of cottonseed oil in contact with the fabric is relatively rapid, and appears to increase the rate of saponification of the natural fatty constituents of the raw cotton; (5) neutral fats (triglycerides) are much more rapidly attacked by alkaline solutions when mixed with readily saponifiable oils, owing probably to emulsification; (6) whilst the rapidity of the action of lime is noteworthy, the complete removal of the fatty matter can only be effected by a subsequent acidification and boiling with sodium carbonate; (7) the general statement is made that complete saponification of the fatty constituents of cotton may be effected (*a*) by a single treatment with sodium hydroxide and rosin, or (*b*) by the lime–"sour"—soda-ash sequence, the latter process having the greater elasticity and certainty.

Effect of the Removal of the Wax on the "Wetting" Properties of Cotton—Beadle and Stevens (97) pressed various samples of air-dried cotton into loose wads, 15 × 10 mm., weighing 0.1 gram each, and let them fall from a certain height onto the surface of a column of water. The time taken to pass through the surface was used as a measure of the "wetting" property of the cotton. The following results were obtained:

Cotton, raw	More than 24 hours
Cotton, bleached but not scoured	31.3 seconds
Cotton, boiled in 1 per cent NaOH	12.3 seconds
Cotton, boiled in 2 per cent NaOH	5.7 seconds
Cotton, boiled, bleached and boiled again	4.0 seconds
Cotton, extracted with ether and alcohol	0.5 seconds

The maximum effect of the caustic soda treatment was produced by boiling for three hours.

Removal of Nitrogenous Matter—The effect of bleaching operations on the nitrogenous constituents has been examined by Schindler (37), Knecht (24), and Higgins (98). Schindler was mainly concerned with the action or sodium hydroxide solutions of increasing concentration, and found that after boiling with sodium hydroxide of 2 deg. Tw. for eight hours the nitrogen content of an Egyptian cotton was reduced from 0.250 to 0.065 per cent. Increase of the concentration of sodium hydroxide to 10 deg. Tw. reduced the nitrogen to 0.028 per cent, whilst further treatment with bleaching powder of 1.5 deg. Tw. reduced it to 0.003 per cent. Using a still stronger solution of sodium hydroxide (77 deg. Tw.), the percentage of nitrogen was reduced to 0.016–0.019. Most of the nitrogen expelled from the cotton remained in some form in the solution, and was not isolated as ammonia. The figures obtained by Higgins (98) for the elimination of nitrogen as ammonia by the method of Osborne, Leavenworth, and Brautlecht confirm this, an American yarn yielding only 0.018 per cent and an Egyptian 0.034 per cent of nitrogen as ammonia.

Knecht (24) gives the following figures for the various stages of the bleaching process, the nitrogen being expressed in terms of that originally present:

After—	Originally Present Percentag of N Which Survives Treatment
Lime boil	54.0
Sour, HCl	40.5
Caustic soda boil	27.1
Sour HCl	16.8
Chemic	6.7
Sour, HCl	5.8

The first three extracts were examined. The first contained 3.7 per cent of nitrogen, but did not give a protein reaction Treatment with alcohol precipitated a gelatinous substance resembling Schunck's pectic acid. The second yielded stearic acid and a small proportion of cotton wax, and the third, which contained 3.46 per cent of nitrogen, appeared to consist mainly of brown coloring matter.

Higgins found that unsized yarn loses about one-third of its protein on stepping in salt solution, and formed the opinion that the usual process of scouring with caustic soda or by the lime—sour—soda-ash sequence removes all the protein. The treatment leaves about 8 per cent of the nitrogen unaccounted for, and it is suggested that this residuum must be non-protein nitrogen, since Hebden (77) found that the first boil effected the removal of all the phosphorus but only 91.5 per cent of the nitrogen. The total loss of nitrogen after different bleaching processes is given as follows:

First boil, 91.5 per cent; second boil, 91.7 per cent; chemic, 92.2 per cent; sour, 92.7 per cent.

The importance of the complete removal of the nitrogenous substances in cotton is emphasized by Trotman (99), who has found that nearly all cases of bacterial damage to finished goods are associated with high nitrogen content.

C—Destruction of Secondary Constituents by Fermentation

For many years, malt extract has been employed to assist in the removal of starch from sized fabrics, but attention has recently been directed to the application of enzymes as a substitute for the alkali "boil." It was shown nearly thirty years ago by Herbert (100) that bac-

teria which destroy cellulose do not attack the cellulose molecule proper until adherent pectins, gums, and tannins have been decomposed. Recently, Levine (101) has examined the action of *B. amylolyticus, B. fimi, B. bibulus, B. carotovorous,* and *B. subtilis* (Ehrenberg) on unbleached cotton in a nutrient medium containing dipotassium hydrogen phosphate, magnesium sulphate, sodium chloride, ammonium sulphate, and lime. He found that the nitrogenous substances and constituents which are soluble in ether are efficiently removed, but that the impurities soluble in alcohol are only attacked by *B. carotovorous* and *B. subtilis.* In the case of *B. bibulus* and *B. fimi,* the cloth became weaker, which may have been due to the action of air on parts incompletely submerged. On the large scale, the material was incubated with the bacterial culture for periods ranging from 24 to 72 hours, with encouraging results. Finally, Rohm (102) has protected the substitution of the alkali "boil" by a "steep" in a 0.1 per cent solution of pancreatin at 20 to 40 deg. Cent. for some hours, other enzymes such as papayotin or ricinus ferments serving to the same end.

D—Dyeing

Influence of Minor Constituents—Schwalbe (19) showed that substantive dyes gave lighter shades on extracted cotton, whereas methylene blue and some other dyes gave darker shades. Rona and Michaelis (103) go so far as to affirm that the apparent absorptive power of cotton for dyes is really due to an exchange of mineral matter for dye, and support this view by the fact that in the absorption of methylene blue the chlorine content and the hydrogen-ion concentration of the solution remain constant.

E—Beetling

Influence of Wax—It is almost impossible to obtain the effect of the beetle finish if wax is left in the cotton. Even the trace of wax left after scouring and bleaching may be sufficient to create this difficulty, and the use of unsaponifiable material in sizing the warp yarn would, of course, aggravate the trouble. For this reason, extraction with suitable solvents is strongly recommended by Fort (104), and a process has been patented which can be applied before or after bleaching, or after dyeing, and even while the fabric is wet (105).

F—Steaming

Cotton becomes yellow when exposed to steam, and it has actually been proposed to impart to white cotton the appearance of Egyptian varieties by steaming under 1 to 1.5 atmospheres pressure for 25 to 50 seconds (106). The yellowing is not due to the fatty constituents of the cotton, and, in fact, F. Erban has found that the phenomenon is intensified if the fat has been extracted (107). The "gums" in the cotton may contribute to the process, but, on the whole, fully scoured cotton is as liable to become yellow as raw cotton. The subject has been studied by Freiberger (108), who came to the following conclusions: (*a*) Bleached fabrics show the strongest discoloration, those bleached in the cold being more susceptible than fabrics bleached in the warm; (*b*) fabrics bleached in the warm with sodium hypochlorite containing an excess of sodium carbonate are less subject to yellowing; (*c*) oxycellulose becomes quite one hundred times as dark as cellulose on steaming, but hydrocellulose is less affected than cellulose. The main cause of the yellowing of cotton on steaming is therefore the presence of oxycellulose.—"Journal of the Textile Institute."

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(*The End.*)

DU PONT ANNOUNCES PONTACYL BRILLIANT BLUE A

The Dyestuffs Department, E. I. du Pont de Nemours & Co., announces placing on the market Pontacyl Brilliant Blue A, which is Patent Blue A. The color will be furnished to the trade, carefully standardized and uniform in every respect. This dyestuff is so well known that it is hardly necessary to speak about its characteristics.

NATIONAL ISSUES GUIDE FOR DYERS OF MODE SHADES

Another novelty in the way of shade cards has been produced by the National Aniline & Chemical Company, Inc. This is a three-leaved folder entitled "Mode Shades for Ladies' Dress Goods."

In the whole range of color terminology the question of "mode" shades is probably the least understood. These generally comprise those delicate nuances of color which are only obtainable by expert and judicious use of combinations. The possibilities in this directions are limitless, and the modern woman is no longer satisfied with the pronounced results of the primary and secondary colors.

The National Aniline & Chemical Company, Inc., recognizing this tendency, offers a shade card containing a palette of seven standard "National" dyes, and accompanying this are forty-eight combination mode shades produced by the use of the colors on this palette. These cover a wide range from the delicate corn and straw yellows up to the bloomy russets and navys.

It is the mauve and lavender shades which are going to be in the greatest demand during the coming year and these, together with the always popular taupe, sand and smoke effects in the latest varieties, are all fully covered in this treatment.

Directions for the preparation of the dye-bath and the method of dyeing are given, and exact information, expressed in pounds and ounces, is provided, showing how each one of these forty-eight shades is produced by an intelligent use of the palette.

This is probably the first time an attempt has been made to guide the users of dyes into the inexhaustible realm of fashion shade combinations, and it cannot fail to meet with the approval of all those dyers who are endeavoring to meet the demands of the market, and to keep in intimate touch with the vagaries of fashionable requirements.

The A. C. Staley Manufacturing Company, corn products, of Decatur, Ill., announces the recent opening of branch sales offices in Boston, New York and Spartanburg, S. C., which will enable them to render even better service to their textile trade. The Boston office at 88 Board Street is in charge of L. R. Dickinson, who has been calling on the mill trade in New England for the last two years. W. H. Randolph, Jr., has been appointed manager of the New York office, 1310 Havemeyer Building, 25 Church Street.

TEXTILE ALLIANCE ASKS QUICK ACTION ON DISTRIBUTION OF REPARATION COLORS

Statement Names Kuttroff, Pickhardt as Concern Protesting Against Alliance Service in This Capacity; Declares U. S. May Lose Current Share Unless Receiving Body Is Designated

Further light on the recent charge of Albert M. Patterson president of the Textile Alliance, Inc., that the Department of State was influenced by present or former German agents to terminate its agreement whereby the textile body had been acting as a distributor of the reparation dyes, has been furnished by a statement issued to the press by the Alliance. This statement follows in full:

The Textile Alliance, Inc., acting on behalf of the textile trades of the United States, feels compelled to make public the present situation regarding the importation into the United States of the so-called reparation dyes, hitherto received from the Reparation Commission and imported for impartial distribution among American consumers by the Textile Alliance as agent of the Department of State.

Owing to the abrogation of this arrangement by the Department of State a condition has arisen of immediate concern to the American consumer, and of very real importance to the nation. Unless action be taken to continue the importation of these dyes, either through a Governmental Department or through some representative non-profit organization, such as the Textile Alliance itself, the German monopoly, acting through its agents or representatives here, must again regain control of the market for importable dyes. It is to avert such a result that the Textile Alliance now seeks to have the Reperation Commission continue the allocation of these dyes, either to the Textile Alliance or to some other American non-profit organization. The Reparation Commission has indicated its willingness to follow any intimation the United States Government may make to this effect. Such recommendation will avoid a situation in which the American consumer must become the helpless tributary of the German dye monopoly—best known to history as the inventors and suppliers of poison gas.

The following brief statement will explain the existing situation:

The Textile Alliance. Inc., is a New York State, non-profit, membership corporation, whose voting members and directors are nominees of trade associations representing practically the entire textile trade of the United States.

In October, 1919, and several times since, the Textile Alliance, Inc., without solicitation on its part, was requested by the Department of State to undertake—and it did undertake—the purchase and distribution of reparation dyes according to the United States.

In October, 1921, a protest was filed with the Department of State against the continuance of this arrangement by Messrs. Kuttroff, Pickhardt & Co., Inc., a New York corporation, owned and managed by American citizens of German birth, who formerly in their corporate or private capacities were agents of the Badische Anilin & Soda-Fabrik, one of the six constituent members of the German dyestuff monopoly.

The Department of State on December 14, 1921, abrogated the arrangement with the Textile Alliance, Inc., stating that there was no dissatisfaction with the work of the Alliance and that there was no objection by the Department to the Reparation Commission continuing the allocation of reparation dyes to American non-profit organizations Later, letters were given by the Department to Messrs. Kuttroff, Pickhardt & Co., Inc., and to other former representatives of the German dye monopoly, stating that the Department had no objection to the Reparation Commission allocating reparation dyes to them.

As a result the Reparation Commission refuses to continue to supply reparation dyes to America until the Department of State shall decide who the recipients of the American portion shall be.

If the allocation be divided among profit-seeking corporations, connected or formerly connected with the German monopoly, the effect will inevitably be to re-establish the control not only of reparation dyes, but of all German dyes, in the hands of the German monopoly, of those representing it.

The Textile Alliance, Inc., does not seek to continue this work itself and would prefer to have it in the hands of a Government Department.

The situation as it now stands is a victory for the German dye monopoly, and the Textile Alliance, therefore, deems it necessary to call attention to the very serious danger confronting the American textile interests and the American people as a whole; a danger which prompt action alone can avert.

TEXTILE COLOR CARD ASSN. INSTITUTES BOARD OF ADVISERS TO INCREASE SERVICE

Luncheon at Astor to Follow Annual Meeting March 1

In order to aid to a greater degree the many industries which come under the influence of color, the Textile Color Card Association of the United States, Inc., has instituted a Board of Advisers, which will represent various basic and affiliated industries.

Through the co-operation of their respective associations, members of this new Board of Advisors represent the knit goods, cotton, worsted, garment, shoe, leather and hosiery industries, and the Metropolitan Museum of Art. These, together with the other leading industries, such as silk, wool, milinery, now officially represented on the board of directors and color committee of the association, will practically embrace all of the textile and kindred industries most vitally interested in color consumption.

The Textile Color Card Association aims to give great-

er service to each individual industry and in turn be brought into more personal and intimate contact with the industries which it is now serving.

The members of the advisory board have been officially appointed by their respective associations, not only to further advancement of industrial color development, but to further promote color standardization as well. They will be the guests of honor at a luncheon, which will follow the annual meeting of the association on March 1 at the Hotel Astor.

The associations represented by the newly appointed board are as follows:

American Association of Woolen & Worsted Manufacturers, John Love, Graupner, Love & Lamprect; the Converters' Association, Arthur Beir, Arthur Beir & Co.; National Boot & Shoe Manufacturers' Association, John C. McKeon, Laird, Schobel & Co. of the United States, Inc.; National Shoe Retailers' Association of the United States of America, Inc., John Slater, J. & J. Slater; Tanners' Council of the United States of America, Burt W. Rankin, Hunt-Rankin Leather Company; United Waist League of America, A. S. Ortenberg, Deutz & Ortenberg; Associated Dress Industries of America, Jacob J. Goldman, Goldman Costume Company; the National Knitted Outerwear Manufacturers' Association, Milton Katzenberg, N. Nusbaum & Co.; Association of Cotton Textile Merchants of New York, W. S. Brewster, Lawrence & Co.; National Association of Hosiery & Underwear Manufacturers, Emery-Beers Company, Inc.; National Garment Retailers' Association, Franklin Simon, Franklin Simon & Co.; the Metropolitan Museum of Art, Richard F. Bach, associate in industrial arts; Cloak, Suit and Skirt Manufacturers' Protective Association, Max Meyer, of A. Beller & Co.; National Association of Finishers of Cotton Fabrics, Phillip A. Johnson, of the Aspinook Company.

NOTES OF THE TRADE

The directors of the Watham Bleachery & Dye Works have declared a dividend of $5 a share, payable March 1 to holders of record February 6.

A new artificial silk throwing company has been formed, under the name of the Textile Throwing Company, at Hawthorne, N. J.

Owen F. Platt has accepted the position as overseer of dyeing for the Paton Manufacturing Company, Sherbrooke, Quebec, Canada. Mr. Platt comes from Springfield, Mass.

The Lyonnaise Silk Dye Works, Inc., Central Falls, R. I., has been incorporated to conduct a dyeing and finishing business. Capital, 500 shares of no par value. Incorporators: Jules Chaussabel, Alben Montchal and Martha Chaussabel.

Foreign Trade Opportunities

Reserved information may be obtained from the U. S. Bureau of Foreign and Domestic Commerce and its district and co-operative offices by duly registered firms and individuals upon written request by opportunity number. The Bureau does not furnish credit ratings or assume responsibility as to the standing of foreign inquirers; the usual precautions should be taken in all cases, and where no references are offered it does not necessarily imply that satisfactory references could not be given. Correspondence may be in English unless otherwise stated. Symbols: *Reported by American consular officers; †Reported by commercial attaches and trade commissioners; ‡Direct inquiries received by the Bureau.

673.*—A mercantile company in Canada desires to purchase *gingham wash goods.* Quotations should be given f. o. b. Canadian station. Cash to be paid. References.

693.*—A merchant in Canada desires to purchase *ducks, cotton tweeds* and all *cotton goods* which are used in the making of shirts and overalls. Quotations should be given f. o. b. Canadian port. Cash to be paid. Reference.

691.†—A firm of manufacturers' agents in South Africa desires to secure the representation of firms for the sale of *textiles,* such as *calicoes, muslins, denims, voiles, silk, artificial silk and cotton hosiery,* and *underwear.*

682.*—A merchant in Sweden desires to purchase haberdashery, *textiles* and women's wear. Quotations should be given c. i. f. Gefle, Stockholm or Goteborg. Payment: Cash against documents. References.

683.†—Agencies are desired by a firm in Victoria, Australia, for the sale of *cotton piece goods,* linoleums and toilet articles. References.

703.*—There is a market in Italy for *colored and white woolen rags and cotton waste material.* Quotations should be given c. i. f. Leghorn or Genoa. References.

771.*—A mercantile firm in Czecho-Slovakia desires to purchase *wool and cotton.* Quotations should be given c. i. f. German, French or Holland ports. Correspondence should be in Czech or German. References.

773.*—A merchant in England wishes to act as selling agent or representative for American firms dealing in *cotton and woolen piece goods* and ready-made clothing for men, women and children. Quotations should be given f. o. b. American port. Reference.

775.*—The purchase and agency are desired by a firm in Nova Scotia for the sale of from 1 to 50 tons of *cotton seine twine*. Quotations should be given f. o. b. Boston or other port of shipment. Reference.

672.†—A commercial agent in South Africa desires to secure the representation of firms for the sale in Transvaal of *cotton goods* and hardware.

776.*—An inquiry has been received from a merchant in Turkey for the purchase and agency for *gray sheetings, drills, ducks,* sugar, coffee, rice, cottonseed oil, flour, etc. Quotations should be given c. i. f. Constantinople. Terms: Payment against documents in New York. References.

780.*—A commercial agency firm in India desires to purchase direct machinery for making envelopes, candles, nails and paper, and to secure the representation of paper manufacturers, *textile machinery manufacturers,* and *gray duck and drill manufacturers.* Quotations should be given c. i. f. Calcutta. References.

781.*—A merchant in Victoria, Australia, wishes to purchase and secure an agency for the sale of *cotton wadding* for padding and upholstery purposes.

678.*—The purchase of linoleum, *curtains, leather cloth, velvet,* etc., is desired by a merchant in Sweden. Quotations should be given c. i. f. Stockholm or Goteborg. Terms: Cash against documents in Swedish bank. Reference.

736.‡—Catalogues and prices are requested by a merchant in Nicaragua with a view to securing the representation of firms for the sale of dry goods, such as *silk and fiber hosiery, curtains, laces,* corsets, toilet goods, *spreads, sheets* and infants' apparel. No reference given.

722.*—An importer in Syria desires to purchase *cotton thread,* also *mercerized and lower grade thread, cotton sheeting (cabots), indigo dyed sheeting, shirtings, oxfords, zephyr, cotton goods with artificial silk stripes,* and *woolen cloth* for men's and women's wear. Samples of the indigo-dyed sheeting were forwarded and may be examined at the Bureau or its district offices. (Refer to file No. 43257.) Quotations should be given c. i. f. Tripoli. Terms: 25 per cent with order and the balance against documents. Correspondence should be in French. Reference.

744.‡—A request has been received from an importer and commission agent in India for quotations on *cotton gin* and railway stores, machinery, electrical apparatus, hardware, enameled ware, wire fencing, vises, anvils; tool steel, spring steel, mild steel bars and plates; mild steel angles; rolled steel beams; galvanized, corrugated and plain iron sheets; brass and copper sheets and rods; brass and copper pipes; steel, galvanized and wrought-iron pipes; boiler pipes and fittings; motor cars, motorcycles and parts; foodstuffs; perfumery; glassware; crockery; beds; *cotton piece goods;* woolens; fents; second-hand clothing; boots and shoes; and sundries. References.

Review of Recent Literature

Boiled-Off Liquor in the Dye Bath. George Emmons, "Silk," February, 1922; p. 75.

After briefly defining the difference between raw silk, ecru silk, souple silk and cuit silk, which depend upon the lengths to which the boiling-off process has been carried; and giving a few precautionary measures, author states that when the soap solution has been used for one or a series of boiling-off operations, the liquor will, of course, have in it a good deal of silk-glue and of soap, and this boiled-off liquor is useful in dyeing silk fiber with many dyes. The bath may be made up of, say, nine parts plain water and one part boiled-off liquor. The effect of this addition to the plain water is thought to be a softening of the dyed silk and a facilitation of the evenness of dyeing. The addition of boiled-off liquor will generally or often result in an alkaline condition of the bath, which may be undesirable, and which may be corrected by the addition of sufficient acetic acid.

Author lists direct cotton colors which may be dyed in such a bath as follows: Diamine Scarlet B, Diamine Fast Red F, Congo Orange R, Oxyphenine, Chlorophenine Yellow Y, Chloramine Yellow, Columbia Yellow, Diamine Blue BX, Benzo Blue BX, Toledo Blue B and Diaminogene. These, however, are to be regarded merely as examples. Examples from the basic colors include: Malachite Green, Rosaniline Blue, Victoria Blue, Glacier Blue, Nile Blue A, Ethyl Purple and Violet 6B. Author counsels, when using the first three basic colors listed, the use of sulphuric instead of acetic acid. Anent dyeing silk with the acid colors, he further notes that it is frequently the practice to use a large quantity of boiled-off liquor; the bath may consist, when the general volume of liquor is filled in, of three parts plain water to one part liquor, while sulphuric or acetic acid is used to give the bath a slightly acid or perhaps distinctly acid reaction. It is not to be understood, he states, that the only way to apply acid colors to silk is by means of a boiled-off liquor bath; it is sometimes permissible to omit the liquor, but acetic acid is nevertheless added to give an acid reaction. When the boiled-off liquor is omitted, it will be well for the dyer to work the silk very carefully, for otherwise he may find his shade uneven.

Continuing his consideration of the acid colors which may properly be applied in a bath prepared with boiled-off liquor, author lists many groups, including Picric Acid; Naphthol Yellow, Martius Yellow, Manchester Yellow, Naphthalene Yellow, Naphthylamine Yellow and Aniline Yellow; Naphthol Yellow S, Citronin A, Acid Yellow S and FY; Xylidine Scarlets; Fast Red, Fast Red

A or O, Rocellin, Rauracienne, Cerasin, Orcelin No. 4 and Rubidin Cardinal Red; Acid Magenta, Acid Fuchsine, Acid Rubine, Fuchsine S and Rubine S; Formyl Violet S4B, Alkali Violet 6B (which is classed as an acid color), Alkali Violet R or 4B and Violimine R, and Sulphone Cyanine G, GR, 3R and 5R, Coomassie Navy Blue G, GN, 2RN and 3R.

Methods for various special and typical colors of these series are given, together with a discussion in many cases of their relative merits.

Patents and Chemical Research. Harold E. Potts, M.Sc. The University Press, Liverpool. Price 8/6.

Although written in relation to the chemical industry, this book deserves study by all concerned with the protection of their manufactures by patents. It would be difficult to find a better statement of the essentials of patent law and practice generally. Different aspects of important points being separately considered are brought out more forcibly and clearly than they could be in closely knit sequences of proposition and qualification, especially as regards the fundamentals of proper protection by patents—to determine what is the real invention in any case, and its range of application, to give ample and accurate indication of its nature, to make full disclosures of how best to carry it out, and to prepare valid claims which shall be wide enough to prevent evasion.

Three pleas are put forward with cogent argument: That endeavor to work a manufacture as a secret is generally futile; that consequently proper endeavor should be made fully to take advantage of the protection afforded by the patent law, and that for full advantage to be taken a manufacturer should have a policy of wide outlook and regard patents as a protection for his own manufacture against infringement and competition, as a weapon against competition and as a means for negotiating concessions in the broadest sense nationally and internationally. In so far as the compulsory working clauses of the patent laws of some important countries make it practically impossible to hold a patent for long without establishing internal manufacture, it may be urged that the possibility of exchanging concessions internationally merits more consideration than it commonly receives.

In regard to secret processes, there is little chance—as the author points out—of the result of one research being undiscoverable by other research, and even in the rare case of a secret process founded on a lucky and unlikely accident there are many dangers probably amounting to certainty of eventual disclosure. The author suggests an injunction might be granted against an employee intending to disclose a secret, but if the injunction should be disobeyed or disclosure should have been made already it seems impossible to restore the secrecy.

On page 16 reference to those inclined to undervalue patent protection as "opponents of the patent system" is temporarily misleading.

The author is to be commended for forcibly indicating the minute care which ought to be taken to insure that everything relevant, though it may arise from accident, convenience or even carelessness, should be considered in preparing the specification of an invention, lest any essential should escape attention, as, for example, the unsuspected influence of containing vessels in making a process work. The author is to be commended, too, for emphasizing that the much used saying "a principle cannot be patented" ought for practical purposes now to be forgotten, the word "principle" having become ambiguous in this connection.

The author very strongly urges that patents both as means of protection and as obstacles to be avoided should be taken into consideration even before research begins, and that thenceforward there should be collaboration with the patent agent. While this is emphatically necessary in chemical cases, such collaboration is to be recommended generally.

This is a book to read, and to read through.—H. C., in "Journal of the Textile Institute."

Manual of Standard Practice for the Power Laundry Washroom. Published by the Laundryowners National Association, La Salle, Ill. 112 pages; price $1.00.

The purpose of the publication is to present in logical order a report of the principal results up to date of the research work on washroom technology which has been done by the Department of Chemical Engineering of the Laundryowners National Association which is maintained at the Mellon Institute of Industrial Research at the University of Pittsburgh.

In all there are eleven chapters, covering the following subjects:

I. Water. With a discussion of hardness and the various methods of water softening.

II. Alkalies. What they are chemically, their choice and use for laundry purposes.

III. Soaps. General discussion of their nature, manufacture and use, with specifications which will serve as a valuable guide to laundrymen in their purchase.

IV. Bleaching agents. With a discussion of those most desirable for laundry work, and their intelligent use.

V. Sours. Why they are necessary, and their harmful effects if not properly used.

VI. Blues. Discussion of the various bluing materials which are available.

VII. Standard formulas for washroom practice.

VIII. L. N. A. Assay Outfit. Description of the apparatus and reagents necessary for carrying out simple methods of chemical control and an aid to the intelligent purchase of supplies.

IX. Sanitary conditions of power laundry output.

X. The use of malt in removing starch in laundering.

XI. The care of metal washing machines.

The publication is another evidence of the activity of the above-mentioned association, which is rapidly becoming well known for its progressiveness and successful endeavor to apply scientific principles and technical knowledge to the practical pursuance of their industry.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

J. E. F.—*Question:* Why is it so difficult to obtain a full rich shade on Tussah silk? I have used dyestuffs that seem to have affinity for the fiber and exhaust the bath, but the shade on drying is always thin and slaty.

Answer: The reason is to be found in the structure of the silk fiber itself. Ordinary Japan silk under the microscope shows no more structure than a glass rod and, when colored by dyeing, reflects light and color as any colored cylinder would. On the other hand, all the wild silks, generally designated "Tussah," appear under the microscope as strongly striated fibers, like a bundle of very fine glass rods. The result is that the reflected light is so broken up by the many reflecting or diffusing surfaces that the true color is obscured by its own high-lights and shadows, and the effect is the same as if gray were added to the color. The same illusion is seen in the white froth of ink and the white powder produced by grinding black or blue glass. However, when the surfaces of the fibers are filled up by some insoluble substance—a finishing paste, for instance—there is a loss of luster but an increase in the depth of color.

A. D.—*Question:* What is the best method of coloring chrome-tanned leather, and what dyes should I use?

Answer: The coloring of chrome-tanned leather is so closely related to the making of the leather that it must always be borne in mind that the obtaining of any particular color is not the whole object. Chrome-tanned leather is regarded as an "empty" material which must be "filled" in order to make good leather. The filling is done by means of wood extracts related to the tannins but containing a minimum of tannin. Logwood is used for blues and blacks, and fustic, osage orange, quercitron and sometimes gambier for browns and other fancy colors, with hypernic when a redder tone is desired. These extracts are applied in a drum at not over 120 deg. Fahr., then fixed by various metallic mordants and washed. This gives a well-penetrated bottom color upon which the final shade is obtained either by the use of acid dyes, which penetrate in some cases and in others dye only the surface, or by the use of direct cotton dyes, which are entirely surface colors. While the extracts may be calculated on the weight of the skins, it is evident that the surface colors should be figured not on weight but on the number of square feet of surface in the pack. After coloring, a fat liquor is applied; this is an oil emulsion made with soap, sulphonated oil or egg yolk, according to the kind of leather being made.

The action of any fat liquor is to modify the color as do oil and glycerine, which may be applied before drying. Then the dried leather generally receives a finish or seasoning, and possibly a glazing, ironing or rolling. The seasoning may be colored to modify the final shade, and often insoluble pigments are used to fill the surface pores. To sum up, in order to duplicate the practical work of another tannery it is very necessary to know every detail of the process and run the laboratory tests on a practical basis as nearly as possible.

B. H. S.—*Question:* Does an after-treatment with chrome and bluestone increase the fastness of all direct dyes more or less, or is it only good for certain ones?

Answer: Fastness to light is improved in such dyes as are capable of uniting with copper, generally with a change in shade; but with those where there is no union the dye may be oxidized and made even less fast than before the treatment. Treatment with bichromate involves, first, an oxidation of the dye, which may or may not then combine with the chromium salt. In this case also there may be an increase in fastness to washing, but not necessarily; all depends on the properties of the dye in question. The same is true of formaldehyde after-treatment; some dyes are improved and others are not. There is no general after-treatment that will improve fastness of all colors in any respect.

P. R.—*Question:* What were the pre-war developers which were lettered A, B, C, D, etc., and what shades did they produce?

Answer:

Developer A—Beta-naphthol: red with primuline.
Developer B—Ethyl beta-naphthylamin: bordeaux.
Developer C—Meta-toluylenediamine: russet.
Developer AD—Amido-di-phenylamine: fast blue.
Developer E—Solution of C.
Developer F—Resorcine: orange.
Developer G—Gamma amido-naphthol sulphonate soda: blue (Blue Developer AN).
Developer H—65 per cent strength of C.
Developer J—Phenol: yellow.
Rubin Developer—Alpha naphthol.

Other products used as developers were generally sold under their true chemical names.

The Capital Silk Company, of Paterson, N. J., has been incorporated with a capital of $50,000. The incorporators are Harry Gold, Sadie Gold and Abe Gold.

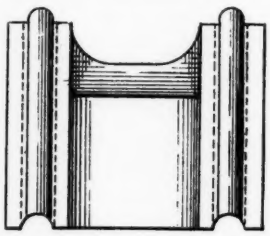
Recent Patents

Coke-Oven Heating Wall, and the Like
(1,404,061; January 17, 1922)

Arthur Roberts, Evanston, Ill. (assignor to American Coke & Chemical Company, Chicago, Ill.)

Patentee has already described in U. S. Patent 1,132,685 the construction of a coke-oven wall which is provided on its interior with a meshwork of interconnected gas passages of such form that the gases traveling therethrough are caused to deflect back and forth in a zig-zag manner as they travel through the wall, thereby being driven with violence against the wall and caused to impinge thereagainst. In the particular construction illustrated in this patent was also shown a convenient form of block from which to build or construct the walls so as to obtain the aforesaid meshwork of impingement passages. The present invention relates to an improved type of heating wall construction, and also the construction of the notched blocks for the same.

One of the objects of the invention is to improve the



form of the notched block so as to thereby cut down or diminish the frictional resistance of the gases as they pass through the wall. Another object is to provide a construction of block which can be very economically molded and manufactured, thus reducing the cost of construction very materially.

The accompanying illustration shows a side elevation of one of the intermediate blocks, which is recessed and notched in such a manner that when set together horizontal passages will be formed by the notches. The upper portion of each block is tapered or V-shaped so as to split the gas streams and thus reduce the resistance to the flow.

One of the four claims allowed is for a coke-oven heating wall comprising horizontal courses of blocks, the blocks of consecutive courses breaking joints with each other, each block having its sides recessed to thereby reduce the width of the central portion of the block, and having its top portion recessed to thereby provide a horizontally extending passage beneath the block above it, said top portion being tapered or wedge-shaped, whereby the side recesses of adjacent blocks co-operate to provide vertically extending passages between the blocks in communication with the aforesaid horizontally extending passages, and whereby the tapered top portions of the blocks serve to split the gas streams and prevent the accumulation of deposit on the top portions of the blocks, substantially as described.

Process for the Purification of Anthraquinone
(1,404,056; January 17, 1922)

Emil Portheim, Prague, Republic of Czecho-Slovakia (assignor to the firm of Kinzlberger & Co., Smichov-Prague, Czecho-Slovakia)

Patentee claims it has been discovered that it is possible to purify anthraquinone perfectly in a single operation without loss. It is only necessary to treat the crude anthraquinone dissolved in a neutral solvent, with the purifying agent. As such purifying agent there may be employed on the one hand alkaline substances, such as caustic alkalies, alkaline carbonates (e. g., carbonates of the alkali metals), calcium hydroxide and the like, which can be used in aqueous solution, and on the other hand sulphuric acid, which can be employed concentrated or moderately diluted. The impurities pass over into the alkali or the sulphuric acid, and the solution is left pure.

Example 1.—Twenty-five parts by weight of crude anthraquinone containing 91.5 per cent of anthraquinone are boiled with 250 parts by volume of chlorobenzene and 10 parts by volume of a 1:1 solution of caustic alkali, the mixture being well stirred. The chlorobenzene and water distill off slowly. The solution becomes gradually purer. The boiling is interrupted when a sample of the solution, mixed with some finely powdered caustic soda and boiled, no longer darkens the color of the latter. Should the dark coloration still take place to a slight degree and longer boiling not lead to the desired result, some potash lye should be added; in most cases, however, the quantity specified is sufficient. The solution is withdrawn, the anthraquinone that is precipitated after the cooling is drawn off, and the chlorobenzene is removed by means of steam and dried. The anthraquinone is perfectly pure.

Example 2.—Twenty-five parts by weight of crude anthraquinone containing 90 per cent of anthraquinone, 450 parts by volume of coal-tar naphtha boiling at 126 to 130 deg. Cent., and 10 parts by volume of a 1:1 caustic potash solution are treated as in Example 1.

Example 3.—Twenty-five parts by weight of crude anthraquinone as above, 250 parts by volume of chlorobenzene and 30 parts by weight of sulphuric acid of 60 deg. Be. are boiled until no further purification takes place. The subsequent treatment takes place as in Example 1. The anthraquinone is of 99.5 per cent strength.

Purification of Crude Anthracene
(1,404,055; January 17, 1922)

Emil Portheim, Prague, Republic of Czecho-Slovakia (assignor to the firm of Kinzlberger & Co., Smichov-Prague, Czecho-Slovakia)

Patentee states that the known processes for freeing crude anthracene from carbazole by means of potassium hydrate are discussed fully in German Patent No. 178,764 and there is opposed to the earlier processes as the most advantageous that based on the fusion of crude anthra-

cene with caustic potash and the subsequent distilling off of the anthracene in a vacuum.

All these processes, including the process of German Patent No. 178,764, have in common the employment of high temperatures. German Patent No. 111,359 recommends the temperature of 260 deg. Cent.; in the process of German Patent No. 178,764 the anthracene is distilled off from the carbazole-potash melt in a vacuum, which likewise requires a temperature of far above 200 deg. Cent. Beilstein, Vol. IV, p. 390, gives the temperature at which carbazole potassium forms from carbazole and potassium hydrate as 220 to 240 deg. Cent.

In face of these statements, the invention has for its basis the discovery that the theoretical yield of carbazole potassium from carbazole and potassium hydrate can be obtained at much lower temperatures if the carbazole be mixed with potassium hydrate in the presence of a solvent for carbazole and anthracene, for example hydrocarbons, and boiling until carbazole potassium is formed, water being meanwhile distilled off. In this manner it is possible to produce carbazole potassium even at the boiling point of toluol. On the basis of this discovery, the carbazole can be separated from the crude anthracene in the theoretical quantity.

By employing the low temperature it is possible to avoid the losses which are unavoidable when working according to the processes of the above-mentioned patent.

The water formed in the aforesaid reaction may be advantageously distilled off mixed with the solvent or larger quantities of caustic potash may be employed, in which latter case the excess of caustic potash absorbs and retains the water.

First example: Crude anthracene, containing 53.4 per cent of anthracene, is purified by dissolving it in naphtha of a boiling point of 145 degrees. Semi-purified anthracene containing 70 per cent of anthracene is obtained.

One hundred parts by weight of this substance, containing 70 parts of anthracene, are boiled with 30 parts by weight of 75 per cent strength powdered caustic potash and 300 parts by weight of naphtha of a boiling point of 145 degrees, and simultaneously stirred, the boiling being continued so long as water mixed with naphtha passes over. If required, the naphtha distilled off must be replaced by introducing fresh naphtha, in order that the anthracene shall certainly remain in solution. The carbazole potassium separates gradually as a heavy sandy precipitate. When the reaction is complete, the hot anthracene solution is drawn off and after cooling there is obtained an anthracene which when drawn off and separated from the naphtha has a degree of purity far above 90 per cent and contains no trace of carbazole. The carbazole potassium is freed from the naphtha by means of steam and simultaneously decomposed into carbazole and potassium hydrate. In this manner it is possible, at temperatures which can be easily reached by indirect steam heating, to separate from each other and obtain anthracene and carbazole in a very simple manner, almost without loss and of an excellent degree of purity.

If in the above example the amount of caustic potash is doubled, complete separation of anthracene and carbazole is obtained under the reflux condenser and even at temperatures below the boiling point of the solvent employed. It is, however, possible to effect the separation in employing the quantity of caustic potash given in the example and using the reflux condenser, but in this case a much longer period of time is necessary to cause the caustic potash to react in a sufficient degree.

Second example: One hundred and fifty parts by weight of crude anthracene containing about 50 per cent of anthracene are dissolved by means of coal-tar naphtha of a boiling point of 130 deg. Cent., and the paste obtained, which contains about 70 per cent of pure anthracene, is heated to 120 deg. Cent. with 200 to 300 parts by weight of naphtha and 60 parts by weight of 80 per cent caustic potash for some hours, the mixture being meanwhile well stirred.

The further treatment takes place as described in the first example. The anthracene is free from carbazole, and the carbazole is free from anthracene.

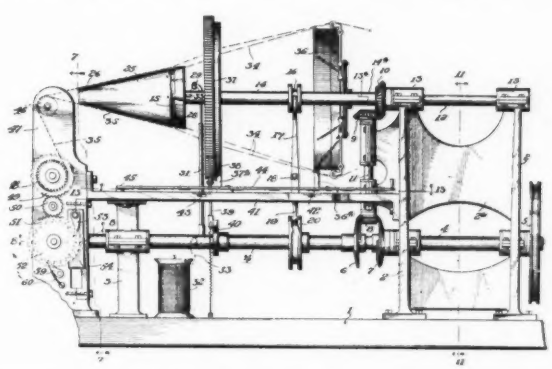
Means for Producing Tubular Fabrics

(1,403,785; January 17, 1922)

EMANUEL INGHAM, San Diego, Cal.

This invention is in the nature of a further development of that covered by inventor's prior Patent No. 1,328,794, dated January 20, 1920, and copending application Serial No. 279,511 filed February 27, 1919.

While the apparatus disclosed in the above-mentioned patent and application is intended for use in producing curved fabrics, U-shaped in cross-section, the present invention contemplates the provision of means for producing a complete tubular fabric in indefinite lengths. The



invention consists therefore in so supporting the parts of the mechanism as to permit of a closed tubular fabric, formed in accordance with patentee's above-mentioned application, to be continuously removed from the machine without the necessity for cutting the same.

The illustration is a side elevation of the improved machine, showing means for supporting the needle and associated parts so that the completed tubular fabric may be continuously removed.

Referring to the drawings in detail, the machine is mounted on a suitable base 1. Adjacent one end of this

base is secured an upright framework consisting of pedestals 2 united by webs 2a, and adjacent the other end of the base 1 is mounted a pedestal 3. A main shaft 4 is journaled in suitable bearings in the pedestals 2 and 3, and carries at one end a pulley 5 to which power may be applied for driving the machine. To the shaft 4 is secured a pair of mutilated beveled gears 6 and 7 which mesh with a beveled pinion 8 secured to the lower end of a short vertical shaft 11 carrying at its upper end a beveled pion 9 which meshes with a similar pinion 10 secured to a sleeve hereinafter described.

A fixed rigid arm or shaft 12 is securely clamped at its rear end in split sockets 13 carried at the upper ends of the pedestals 2, and such shaft extends forwardly nearly the full length of the machine, thus constituting a cantilever structure.

Journaled on this shaft 12 is a sleeve 14 having a rear portion 14a to which the pinion 10 is rigidly secured, the section 14a being united with the section 14 by means of a longitudinal separable coupling 13a. At its forward end the sleeve 14 carries a circular oscillatory needle 15 similar in all respects to the needle shown in detail in the prior applications.

A grooved collar 16 is secured to the sleeve 14, and in the groove of such collar works the bifurcated end of a level 17 pivoted at 18 to a fixed bracket and having its depending lower end 19 engaging a cam grooved in a cam member 20 which is secured to the shaft 4.

The end of the shaft 12 projects forwardly beyond the needle 15 and on such forwardly projecting end is rigidly mounted the form around which the fabric is woven. This form consists of a circular ring or disc 21 clamped to the shaft by means of a setscrew 22. This ring is disposed adjacent the needle and is of substantially the same diameter. It constitutes the foundation around which the weft thread is laid by the needle and encloses the loop interlocking mechanism. This body when in position is circular at the rear end and flattened and elongated laterally at its front end.

A short tubular thread guide 28 of suitable shape is secured to the needle and the weft thread 23 passes to the needle through this tube from the flared mouth 29 of a thread guide 31, the upper end 30 of which is preferably swiveled.

It will be understood that as the needle oscillates, the swiveled end 30 of the thread guide swings from side to side as may be required to properly accommodate the pull of the thread. The weft thread 33 enters the lower end of the guide tube 31 from a fixed reel 32.

The figure 34 designates the warp threads which, as in the prior application Serial No. 279,511, pass through a tension device 36 and a heddle mechanism 37, such threads being fed from fixed reels (not shown).

The heddle mechanism is operated as in said prior application by means of ratchet mechanism 39 actuated by a cam 40 on the shaft 4. The tension and heddle mechanisms which are entirely free from the arm 12 each comprise two separable halves and are supported on pedestals 36a and 37a, respectively. The selections of the tension mechanism pedestals are adapted to slide in an arc-shaped groove 42 and the sections of the heddle mechanism pedestals are adapted to slide in an arc-shaped groove 43, these grooves being formed in a suitable supporting table 41 and being struck from a common center. This center is the pivot pin 45, on which pin is pivoted a pair of operating handles 44 which are suitably connected to the sections of the tension and heddle mechanisms as described in the prior application.

It will be understood that as the fabric 35 is woven by the oscillating needle 15 around the form 25 it is drawn off of the front end of such form by means of the take-up mechanism. This take-up mechanism comprises a guide roller 46, over which the fabric passes, such guide roller being supported near the upper end of a pair of standards 47. Also journaled in these stands is a take-up roller 48 on which the fabric is wound. The roller 48 has secured to one end a gear 49 which is operatively connected to a similar gear 51 by means of an intermediate pinion 50. This construction renders it possible to vary the speed of the roller 48 by taking off two of the gears and substituting others of different relative diam eters. The gear 51 is journaled on a stud carried by one of the standards 47 and has formed integrally therewith a ratchet wheel 52. This is adapted to be engaged by a pawl 53 pivoted to a reciprocating block 54 suitably mounted in guideways in the standard 47 and actuated by means of a lever pivoted and caused to vibrate by means of a cam secured to the shaft 4. The end of the lever is preferably rounded and fits into a notch or pocket in the block 54. The lever is actuated in one direction by means of a spring. A locking pawl 59 pivoted to the standard 47 and urged against the ratchet 52 by means of a spring 60 serves to prevent backward rotation of the take-up roll 48.

Among the claims is that for the combination with a rigid arm of a circular weft needle mounted for oscillation thereon and a warp supporting form associated with said needle and carried wholly by said arm.

Drawing Tube for Ring Spinning Machines

(1,404,165; January 17, 1922)

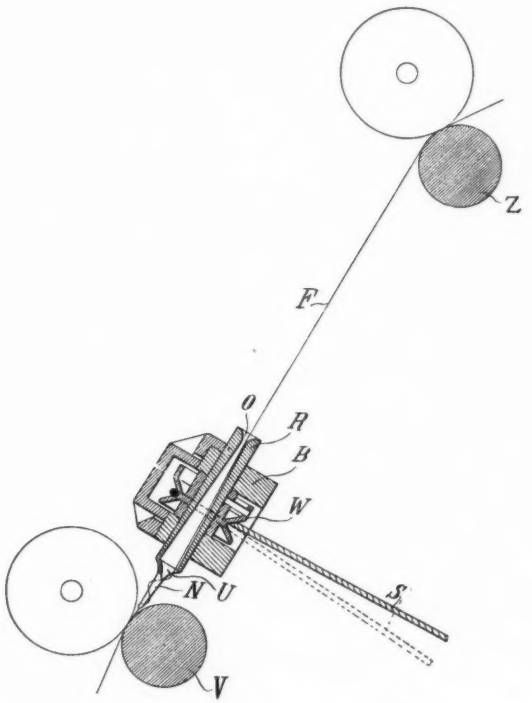
Ludwig Schoksch, Biala, Austria (assignor to firm of G. Josephy's Erben, Bielitz, Austria)

Patentee states that the use of the ring spinning machine for spinning carded yarn requires highly skilled operators when it is desired to work the ring spinning machine in an economical manner, with the smallest possible number of operators, because it is difficult to insert broken roving into the drawing tube while the machine is working.

This is the chief reason why the ring spinning machine has up till now been employed only to a comparatively limited extent for working on carded yarn. Consequently the designers of ring spinning machines have been directed to producing a drawing tube which will feed the yarn automatically to the drawing rollers.

This invention has for its object to provide an improved drawing tube for ring spinning machines working on carded yarn which feeds the yarn automatically to the drawing rollers, so that it is no longer necessary to draw the roving with a hook through the drawing tube, but it is sufficient to introduce the roving by hand into the upper opening of the drawing tube.

The automatic drawing of the roving through the drawing tube is effected by providing the drawing tube according to this invention with a conical bore instead of the usual axial cylindrical bore, said conical bore increasing in diameter from the inlet opening toward the yarn outlet opening. Or it is provided with a bore inclined toward the axis of the drawing tube.



In the illustration, the roving F delivered by the feed rollers Z passes through the inlet aperture O into the drawing tube R, which is mounted in the tube stand B. The drawing tube is rotated by means of the cord S passing around the whorl W.

The bore of the drawing tube, instead of being cylindrical as usual, is made of conical shape, enlarging from the upper aperture O toward the needle N, or the bore of the drawing tube is inclined to the axis of the tube. By this means the end of the roving which enters the upper aperture O is carried round by its friction against the side of the drawing tube.

The centrifugal action produced by the rotation of the roving imparts to the latter a tendency to increase its radius of rotation and thus move away from the axis of rotation of the tube. The result of this is to cause the end of the roving to follow the downwardly increasing bore of the tube or the bore which is gradually receding from the axis of the tube, and thus pass through the latter, whereupon on issuing from the lower aperture U the roving is caught by the needle N and fed to the drawing rollers V. For yarns which are being spun with small draw, such as waste cotton, waste linen and the like, the arrangement of the drawing tube according to the illustration is sufficient. For woolen yarns, however, which are spun with a larger draw, it is necessary to impart to the roving that vibrating motion which is attained, when spinning with the selfactor, by the turning of the roving over the point of the rotating spindle, and which enables to attain the large draw.

For this purpose the upper end of the drawing tube is not truncated but is provided in the same manner as the lower end with a needle over which the roving is compelled to turn once at each revolution of the drawing tube in a similar manner as it does over the point of the spindle of the selfactor.

The improved drawing tube constitutes an important improvement in ring spinning machines working on carded yarn, the manufacture is rendered more easy and is increased, because it allows of dispensing with the drawing of the roving by means of a hook through the tube, which operation takes up a great deal of time and requires skilled operators. The attendance on the machine is thus considerably simplified.

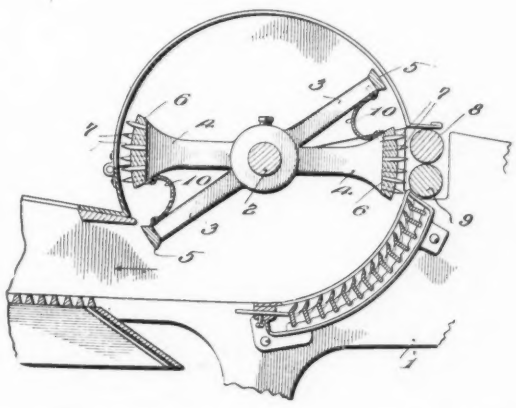
Besides, by this construction of the drawing tubes the applicability of the machine and the quality of its yield are increased, because both materials with a large draw and such with a small draw can be spun in a profitable manner.

Beater for Cotton Pickers

(1,403,975; January 17, 1922)

Amasa St. Onge, Providence, R. I.

This relates to cotton pickers, and particularly to devices employed for opening and combing the cotton so as to clean the staple in its progress to the spinner. The object of the invention is to provide a simple and highly efficient beater which will effectively open up the cotton and then shake out the dirt without in any way weakening the staple or creating waste, the improved beater being adapted to first shred the cotton as it is feeding in the



usual manner and to then immediately strike it a gentle blow to dislodge foreign matter.

The illustration is a vertical sectional view taken transversely of the power shaft and showing feed rolls, grids and second grids, stripping plate and bonnet of conventional form.

There is indicated a supporting frame 1 and at 2 is shown a shaft adapted to be suitably power driven. Fixed to this shaft are a plurality of pairs of arms 3 and 4, the arms 3 forming the support for beater bars 5, these arms and bars constituting what shall be termed the plain beater. The arms 4 are the support for cross-pieces 6 from the surface of which project pins 7, and are termed the pin beater. The arms of each pair 3 and 4 are in alignment, but the respective pairs of arms are on different radii; complementary arms of each pair—that is to say, an arm 3 and an arm 4—are arranged with a slight intervening space of less than 90 degrees between them, so that upon the clockwise revolution the pin beater will engage the cotton staple slightly in advance of the blow on the latter from the plain beater, the engagement of these two arms with the staple occurring at the point of feed of the latter between the rollers 8 and 9. In order that the suction in the machine shall not effect a drawing of the staple between the pin beater and the plain beater, the space between the complementary pairs of beaters is bridged with a shield 10, preferably of sheet metal.

The operation of the beater will be apparent and the advantages resulting from first opening up the cotton by engagement of the pin beater therewith and the subsequent quick beating of the cotton so combed which effectively loosens all foreign matter are manifest. A picker embodying features of the improved type herein disclosed may be operated with a great saving of power, the speed at which the beater must revolve being less than that where but a plain beater or a pin beater is alone employed, and the improved beater insures removal of more dirt from the staple and this means better running work and less waste.

Method of Making Acetic Anhydride

(1,403,920; January 17, 1922)

CHARLES J. STROSACKER, Midland, Mich. (assignor to the Dow Chemical Company, Midland, Mich.)

While it has heretofore been proposed to make acetic anhydride, $(CH_3CO)_2O$, by reacting on a suitable acetate with sulphur chloride (see German Patent No. 132,605), this method of manufacture has since been superseded by other methods, the more modern of which will be found described in Worden's "Technology of Cellulose Esters" (Vol. VIII, pp. 2526 et seq.). The principal of these more modern processes is that of Goldschmidt, who, in his German Patents (Nos. 222,236 and 241,898) points out the deficiencies in the older method above referred to.

Inventor has found, however, that by proper manipulation, and particularly by proper control of the temperatures and pressures employed in the process, such older method, consisting, as stated, in reacting directly with sulphur chloride on a suitable acetate, may be made a commercial success. Obviously, in view of the greater convenience in handling sulphur chloride, instead of the reagents involved in the so-called more modern processes, this older process is the preferable one.

The present improvements accordingly consist of the steps hereinafter fully described, the following description setting forth only one specified method of carrying out the process.

Inventor uses a suitable acetate, preferably sodium acetate, two parts, and, placing the same in a suitable vessel which can be closed, adds gradually thereto one part of sulphur chloride, specifically the dichloride (SCl_2). During this stage in the operation the mixture is kept under pressure, approximately 5 pounds above atmospheric, and is cooled the while by applying water to the outside of the vessel, so as to maintain a temperature of the contents within at approximately 20 deg. Cent. Under these conditions, the resultant acetic anhydride does not tend to volatilize to any serious extent, but remains relatively quiescent in the mixture.

The principal reaction that occurs is well understood, being represented by the formula:

$$8CH_3COONa+3SCl_2=4\begin{matrix}CH_3CO\\CH_3CO\end{matrix}\!\!>\!O+Na_2SO_4+6NaCl+S_2$$

This reaction is practically instantaneous, and is complete as soon as the ingredients have been brought together in the proper proportions as indicated.

As soon as such reaction is complete a vacuum is applied and the mixture gradually heated so as to distill off the acetic anhydride, the temperature being gradually carried up to approximately 110 deg. Cent., by which time all of the anhydride should have distilled over. There will be some acetic acid formed incidentally to the distillation stage which requires to be fractioned off from the product, but the amount of such acid is not serious, the formation thereof, as well as of other more baneful intermediate products, such as sulphur dioxide, being almost entirely prevented by carrying out the reaction and distillation under the conditions of temperature and pressure described.

Other modes of applying the principle of this process may be employed instead of the one explained.

The claims are:

1. The method of making acetic anhydride, which consists in mixing an acetate with sulphur chloride; maintaining the mixture at a temperature of approximately 20 deg. Cent. and under a pressure of approximately 5 pounds above atmospheric; then applying a vacuum and gradually raising the temperature to approximately 110 deg. Cent., whereby the anhydride is distilled off.

2. The method of making acetic anhydride, which consists in slowly adding one part of sulphur dichloride to two parts of dry sodium acetate; maintaining the mixture at a temperature of approximately 20 deg. Cent. and under a pressure of approximately 5 pounds above atmospheric; then applying a vacuum and gradually raising the temperature to approximately 110 deg. Cent., whereby the anhydride is distilled off.